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MONTREAL, Eastern Townships Bank Bldg. TORONTO 143-153 University Ave. WINNIPEG, 34 Royal Bank Bldg. LONDON, ENG., 88 Fleet St.

Vol. V. Publication Office, Toronto—January, 1915 No. 1

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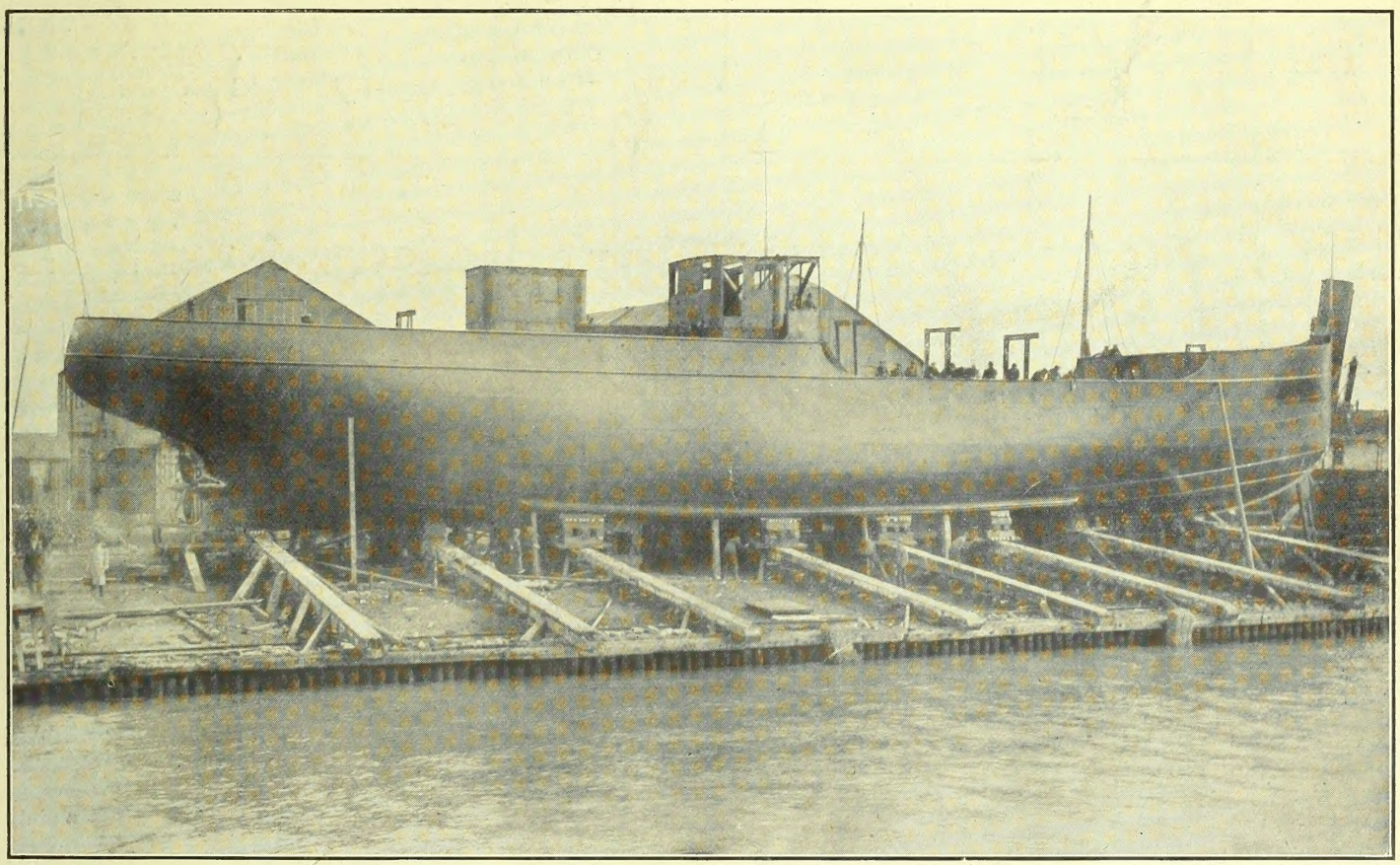

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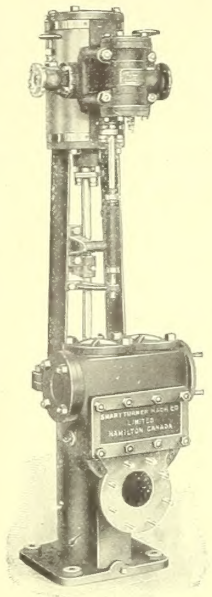

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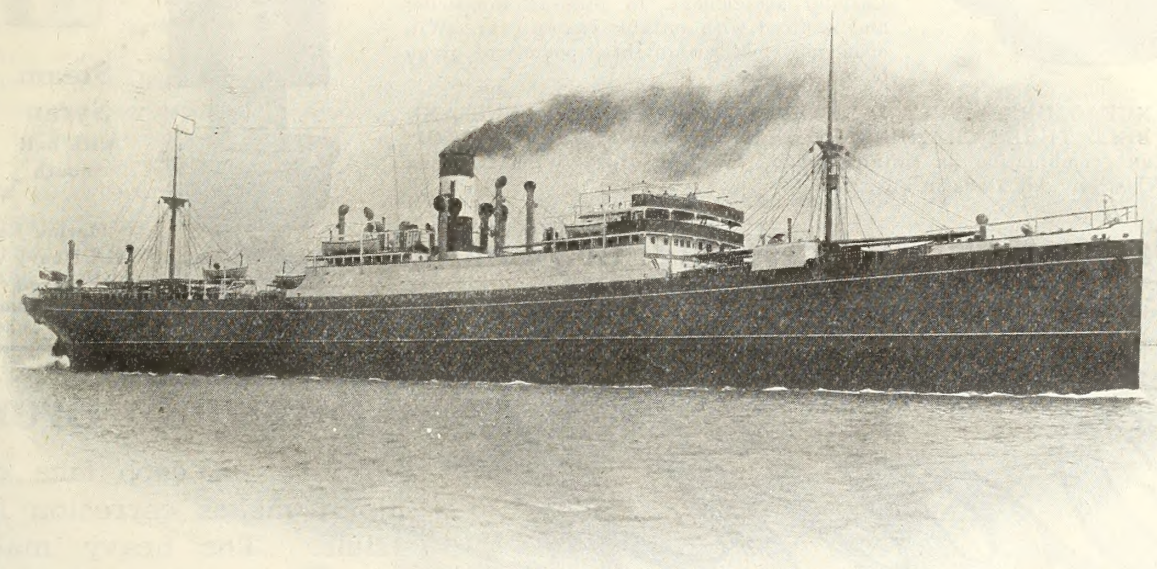

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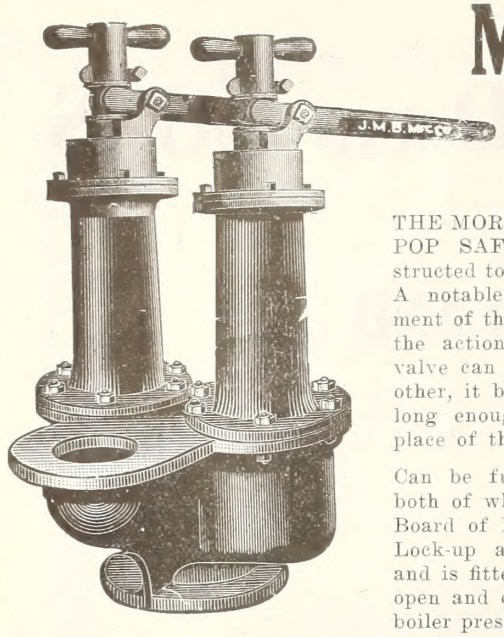

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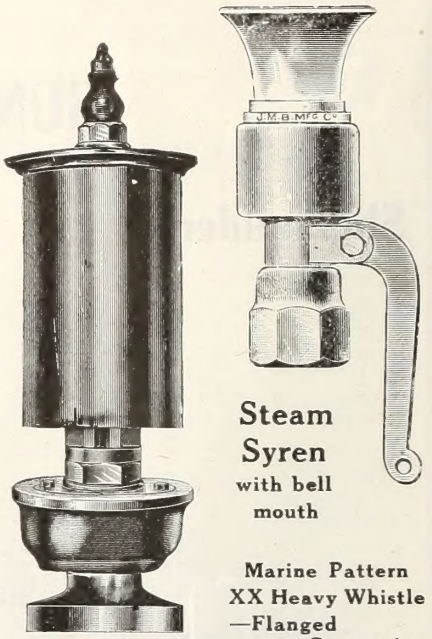

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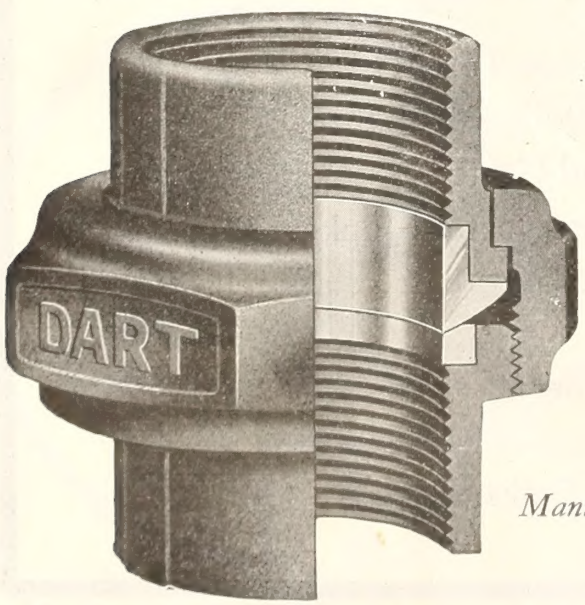

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Every Dart Union bears our trade-mark, YOUR GUARANTEE. We will replace 2 for 1, any of these couplings that are not right.

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Sold by jobbers at every port

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The World's Shipbuilding and Marine Engineering in 1914

Taken all over, the year just gone cannot be said to have been a lean one, so far as shipbuilding and marine engineering is concerned. True it is that the mercantile tonnage shows not only a very heavy decrease compared with the previous record year, but also a most substantial falling-off when compared with the years 1911 and 1912. In spite of these quite outstanding features, 1914 will rank as a banner year in the twin craft in other respects.

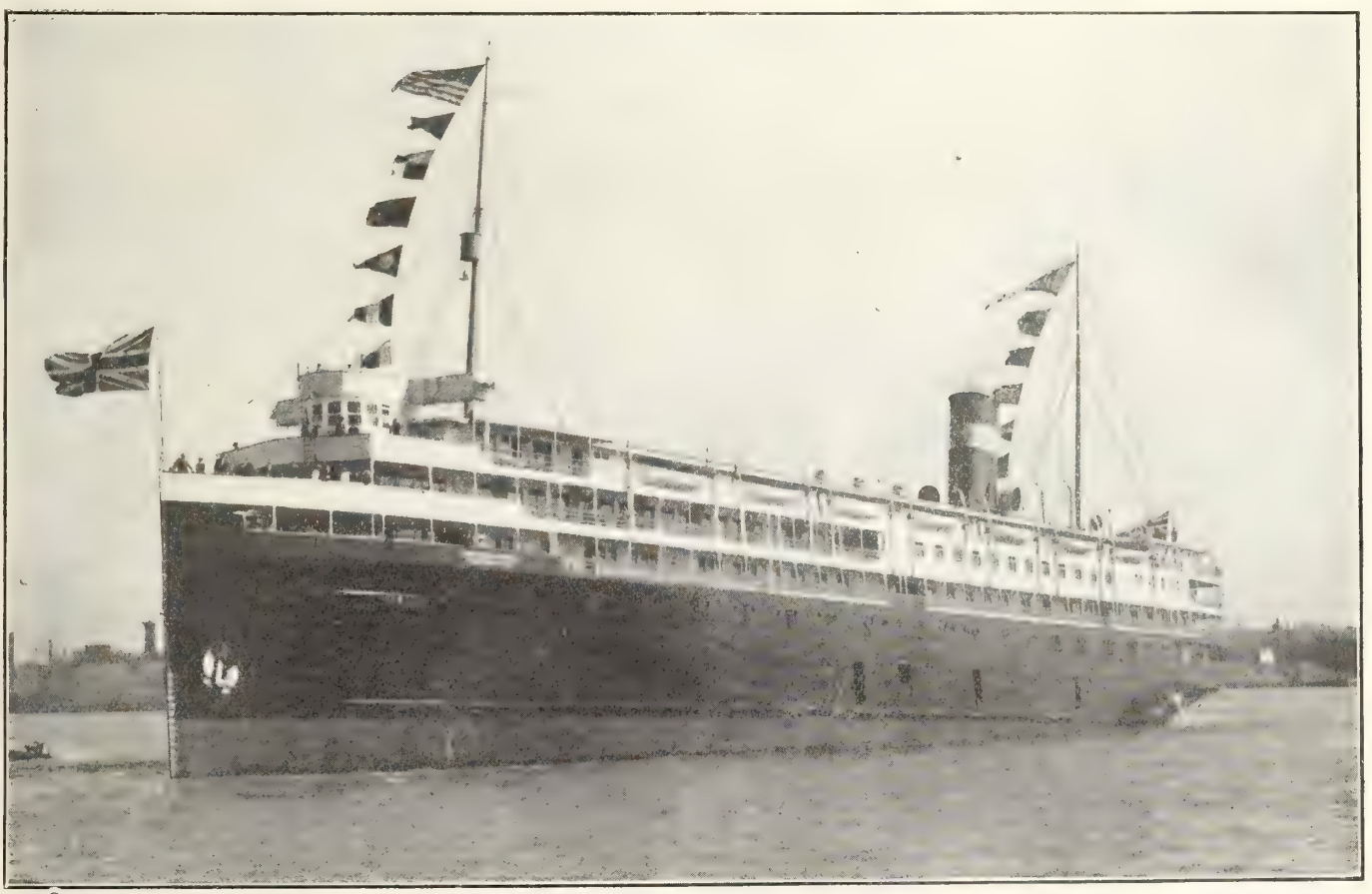
IF there be one thing more than another that the European War now raging has served to give point to, it may unhesitatingly be stated that the twin industry of shipbuilding and marine engineering carries the distinction. Despite the general disorganization which the declaration and continuance of the war by the Allies on behalf of world-wide freedom and civilization has brought about, it is indisputably evident that no sphere of manufacturing enterprise has suffered less as a result than shipbuilding and its contributories. At no time, as now, has the call and need for shipping capable of traversing the great ocean highways been so loud, clear and insistent and, correspondingly also has the impotence—self-imposed and otherwise—of those who suffer most, been so amply demonstrated.

Transportation and other requirements by the Allies have been responsible for the disappearance from trade and commerce pursuits of the cream of their merchant shipping, and fear of capture by warships of the Allies have led to the internment of those of the enemy. It is in the matter of shipping possessed by neutral nations, as, for instance, the United States, that the greatest hardships are being felt, and as a consequence more or less activity is being displayed to offset these, accompanied as might be expected by considerable irritation on the part of those more directly concerned. To meet the need promptly, buying as against building is being vigorously advocated, and as vigorously combated.

Great Britain Still Leading.

As will be gathered from the accompanying data and statistics, available as in former years through the courtesy of the Glasgow Herald, Great Britain has held her own as the world's premier shipbuilding and marine engineering nation, not only having been equal to the task of catering to her own requirements, but of in large measure supplying those of other countries. In her case, the war arrested the oncoming depression and created instead a shipbuilding and marine engineering boom; and while as may be expected naval activities are paramount, those of the merchant service are in nowise being neglected.

The lack of shipbuilding enterprise on our ocean shores, and more particularly on that bordering on or adjacent to the Atlantic was never more highly accentuated than it is to-day, and the pity of it all is that but for political jealousies and other kindred motives we too would have been sharing in this ship construction. As stated a year ago, we in Canada have not yet become sufficiently enthused with, nor do we yet seem to realize, the importance to our commercial and industrial standing among the civilized and progressive nations of the world what due regard to the establishment and nurture of shipbuilding and marine engineering would accomplish for us. We are, however, getting a wholesome lesson read us these days, and one of the pointed features finds its exemplification in the prodigality of



NORTHERN NAVIGATION CO. S.S. NORONIC, BUILT BY THE WESTERN DRYDOCK AND SHIPBUILDING CO., PORT ARTHUR, ONT., AND COMMISSIONED MAY, 1914.

shell and other contracts which have been placed with us on account of the war. We were fairly well situated to handle these, but in the matter of shipbuilding or marine engineering our facilities or lack of same, with possibly one exception, shut us out.

Illustrations of a variety of vessels built in Canada and Great Britain for Canadian owners and services, and which went into commission during 1914, accompany this article.

British Trade.

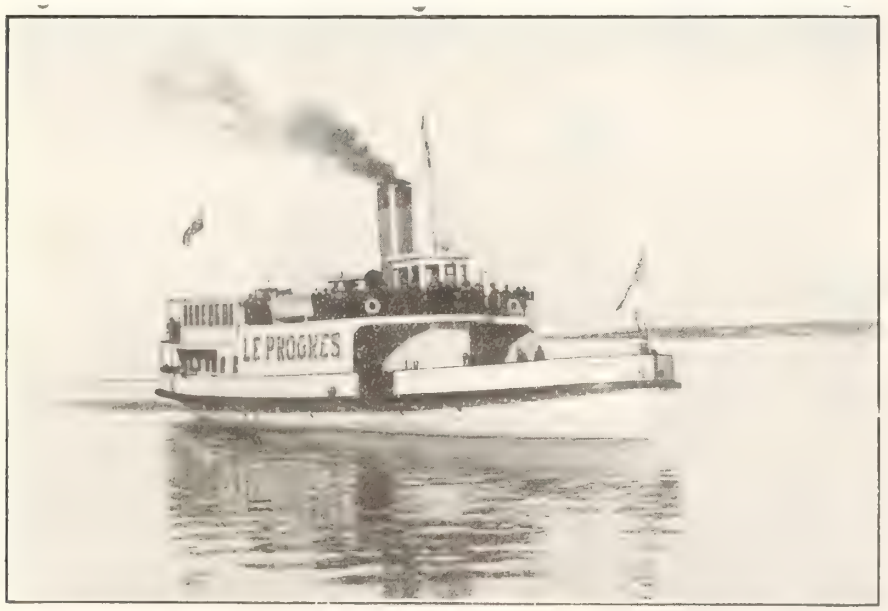
The impregnable position of British trade and commerce is strikingly emphasized in the accompanying reports. The Empire has been at war for over five months with a powerful enemy, and yet the flow of her trade has been scarcely interrupted. Since war started our engagements have been mainly entrusted to our land forces and, presumably because our Navy has apparently played the smaller part, captious critics are to be found who doubt the ability of our Fleet to justify the reputation it enjoys of being the Empire bulwark. If such critics cannot be convinced by reasoning that sea power means much more than merely engaging the enemy fleet they can find convincing proof of the might of the Navy in a comparison of the highly satisfactory trade conditions that obtain with us at the present time and the sorry plight of trade in the countries of our enemies.

It would, however, be useless to deny that the declaration of war did not shake the whole fabric of commerce for a time, but the solid base on which the trade of the Empire is built was proof against the shock, and within a few weeks of the commencement of hostilities markets rapidly assumed a normal state, or at least adjusted themselves to the slightly altered conditions. While it is true that dominion of the seas safeguarded trade with foreign countries, the economic chaos that naturally followed the outbreak of a European war was outwith the scope of armies and navies to deal with, but the bold generalship shown by the financial advisers of the Government brought the country out of a difficult and intricate situation with triumph.

CANADIAN GOVERNMENT BUCKET DREDGES NO. 14 AND 15, BUILT BY THE COLLINGWOOD SHIPBUILDING CO., COLLINGWOOD, ONT., AND COMMISSIONED MAY, 1914.

In the Shipyards.

With regard to shipbuilding, the international trade situation has never been more interesting—or more tragic—than it is at present. Germany, Belgium and Austria-Hungary are ruled out as competitors, and are not likely to be keen rivals for a good many years to come. Something may, however, be said about the position in which British shipbuilders and marine engineers find themselves in consequence of the war. That they are very busy is not saying very much. Some are busier than they have ever been in times of peace; costs of production are extremely high, rapidity of workmanship is called for by all owners—Admiralty and private—and rapidity of workmanship is just what cannot be obtained except on Government contracts.



CITY OF THREE RIVERS FERRY STEAMER "LE PROGRES," BUILT BY THE DAVIE SHIPBUILDING & REPAIRING CO., LEVIS, QUE., AND COMMISSIONED SEPTEMBER, 1914.

The war completely revolutionized trade conditions, and converted the prospect of a period of depression into that of a period of unparalleled activity. It also brought into very strong relief the immense capability of the British shipyards to turn out great quantities of work. Very soon after war was declared large numbers of the workmen—one in seven in some districts—were either called up as reservists or volunteered for naval or military service, but the trade unions, cordially assisted by their members, arranged with the employers' organizations that all restrictions on labor should be withdrawn, that men should be allowed to work overtime to any extent, and to shift from yard to yard in accordance with the emergencies of the most pressing naval work. In addition, the employers arranged among themselves that naval firms should have the option of calling for workers from mercantile yards whenever they required these, and that the mercantile firms should always grant their request.

The result of all this was that shipyard and engine-shop labor became at

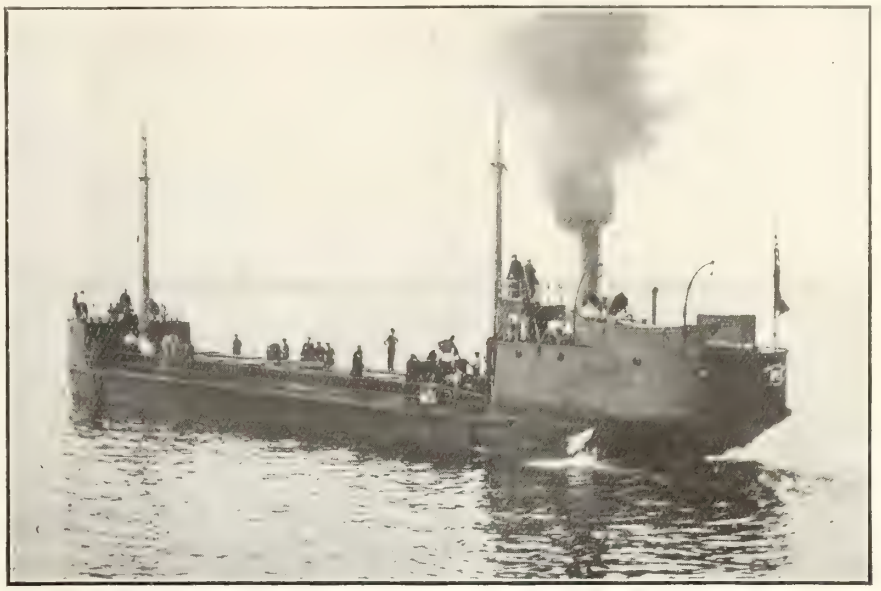
once more "elastic" that it had ever been, and that pressing naval work made far greater progress than it would have made in times of peace. When, however, the early war clouds rolled away, and shipowners began to see that they were to have more, and not less, work for their vessels, there came many new contracts, and builders found themselves largely unable to cope with the work which was offered them. Now their greatest difficulties are those of obtaining sufficient labor, even at the high wages now ruling, and sufficient materials even at the equally high prices which are charged.

Markets for Ships.

There is, it need hardly be said, no question of the capture of markets in shipbuilding. British shipbuilders did not envy Germany or Austria any of their customers. Both countries confined themselves very largely to work for home owners, and to that Great Britain made them heartily welcome. Not only so, but there were placed in Great Britain by the leading German owners more orders than were taken from her by German shipbuilders, so that the balance was on the British side.

When war was declared there was a number of vessels under construction in British yards for German and Austrian owners, and their builders found themselves with these on their hands. Probably very few of them will lose money on such work, as the demand for carrying capacity is now such that all available ships of normal types find a ready market. Prices of new and second-hand tonnage have advanced greatly; so have freights, and so have wages. The result is that a very much larger amount of money is in circulation, although the margin of profit everywhere is not so large as the financial transactions would seem to warrant. There is a splendid market for ships, and British shipowners have the opportunity of their lives.

The revision of business methods, and the inauguration of new ways of push-



ONE OF THREE LIGHTERS BUILT BY THE POLSON IRONWORKS, TORONTO, TO THE ORDER OF THE CANADIAN GOVERNMENT FOR HUDSON BAY SERVICE.

CANADIAN CUSTOMS CRUISER "MARGARET," BUILT BY J. I. THORNYCROFT & CO., SOUTHAMPTON, ENGLAND, AND COMMISSIONED APRIL, 1914.

ing British goods in foreign markets are being urged on every hand and in such campaigns the shipowner must necessarily take a leading part. It is well, therefore, that they should be adding to their fleets now, so that they may not only carry all possible present trade but also be prepared for whatever developments may take place on the close of the war.

24-INCH HYDRAULIC SUCTION DREDGE "CYCLONE," BUILT BY THE POLSON IRON WORKS FOR THE CANADIAN STEWART CO., CONTRACTORS TORONTO HARBOR IMPROVEMENT.

With Germany's mercantile fleet locked up, there is a great deal for British ships to do, and even when that fleet is released—if it ever is released in anything like its old magnitude—its owners will find themselves so much out of touch with the changed conditions and so much the victims of a quite natural prejudice in what are at present combatant and non-combatant countries, that it will take them a long time to regain their lost position.

By bringing on war Germany played wholly into the hands of British shipowners, shipbuilders and steelmakers, and the longer the war continues the more trade will be done by these. At present they have a very large amount of trade, and they are preparing for more, so that, when the many workers return from their war duties, the shipyards and engineering works of the United Kingdom should be in a condition the very opposite to those of Germany. They should be thoroughly well equipped and thoroughly staffed, and capable of holding their own even more than they have ever done in the past.

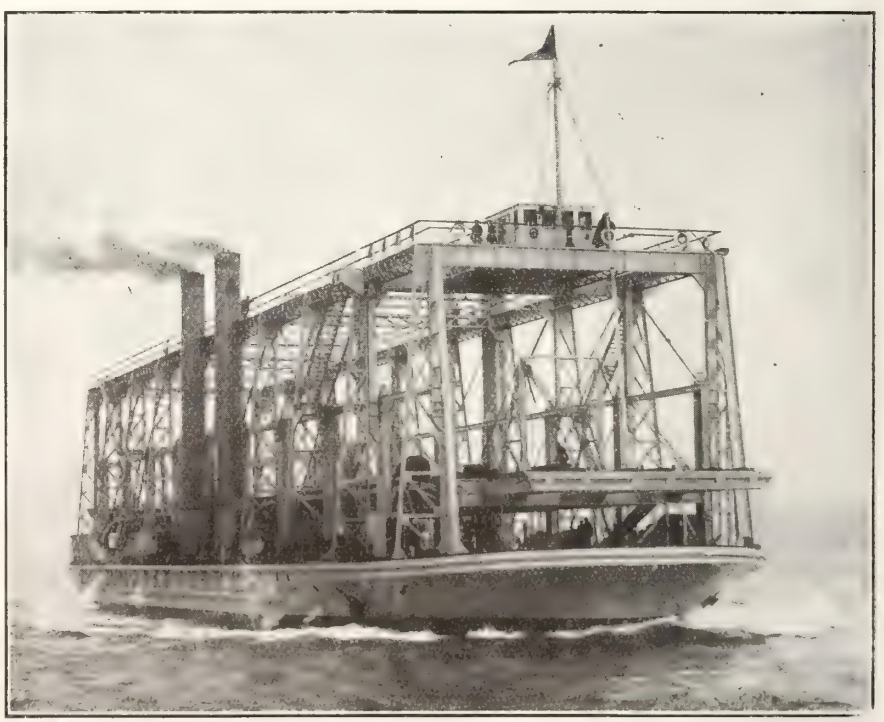
War-time Shipbuilding.

In all the reports of shipbuilding work done in the many countries and districts in the world one fact stands out very clear. The period through which the industry was passing when the European War broke out was one of general uncertainty, and the immense international conflagration threw practically every trade out of gear, and opened up new vistas, either of good or bad prospects. The war has formed a turning point in many industries, and not the least in shipbuilding.

In the country most directly affected —Germany—it has brought about a cessation of activity in many trades. All the more reliable reports go to show that its harbors are practically idle and its shipyards almost closed. One very significant indication of the condition of shipbuilding in Germany is that the Germanischer Lloyd ceased very soon after war was declared to issue fresh supplements to their Register Books—thus practically admitting that there was not likely to be any necessity for classifying new vessels—and that the Register Book itself is not to be issued until the war is over. What this means may best be understood if we can imagine Lloyd's Register of British and Foreign Shipping closing down in Great Britain. It may be the case—very likely is—that the eligible officers of the German Society have all been called up for active military service; but if there was any work going on in the yards a sufficient number would have been left to survey the construction of ships.

For the time being Germany has ceased to be a shipbuilding country, just as her ships have ceased to sail on the oceans of the world, and are either sheltering in her own ports, interned in those of neutral countries, or captured by Great Britain or her Allies. When all this is remembered the splendid record of work in "the Fatherland" which we are able to give is all the more remarkable, for it is a splendid record of work, no matter how the rulers and people of Germany may have offended civilization and outraged all the better feelings of humanity. Here, we are not dealing with international politics, or statesmanship, or warfare, but with international industry, and we may therefore give full credit to the country with whom we are at war for industrial enterprise and activity.

Germany launched in 1914 a larger tonnage than the Clyde. So far as the records go it has not done this very often and but for the fact that there was a serious falling-off in the Clyde output



NATIONAL TRANSCONTINENTAL RAILWAY CAR FERRY "LEONARD," BUILT BY CAMMELL, LAIRD & CO., BIRKENHEAD, ENGLAND, AND COMMISSIONED AUGUST, 1914.

it would not have done so in 1914. The mere fact, however, that in a year which consisted practically of seven months—for very few merchant vessels were launched in Germany after war was declared—there should have been launched nearly 200 vessels of over half a million tons gross measurement, says a great deal for Germany as an industrial nation. What her total would have been had there been no war is a question difficult to answer, but it would in all probability have set up a very high record indeed.

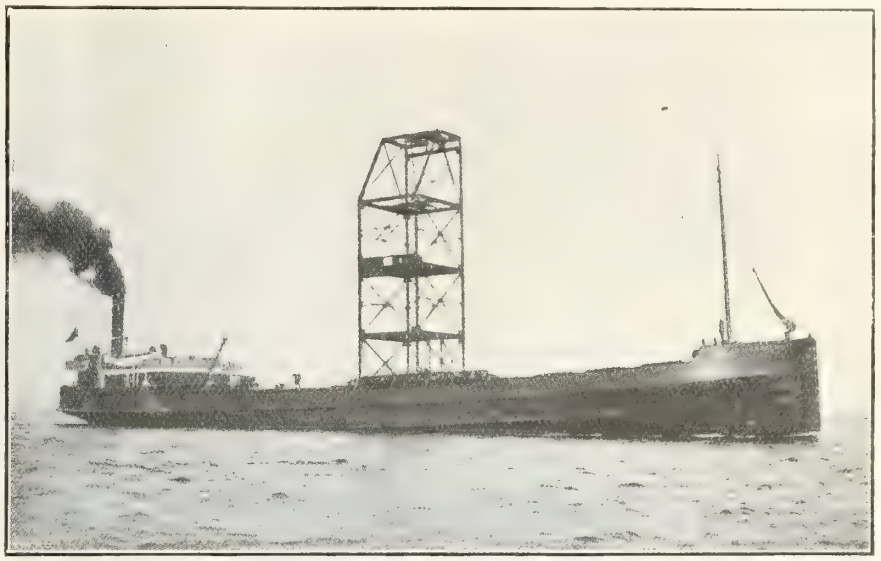
Germany could build ships and could run them, but whether she will be able to do the one or the other a year hence or two years hence no one can say. Certainly if economic conditions were a handicap—as they were—in times of peace, they are not likely to be anything else when times of peace come again, and the shipbuilding firms are likely to obtain even less outside work than they did before—that is, if many of them are not ruined before then by the effects of the war.

In the other "combatant" countries, too, good work was being done before war broke out, as will be seen by the returns from France, Austria-Hungary, and Belgium. In France good work is still being done, although many of the workers have been called up for military service. In Austria all the British staffs of the newer yards have left the country, and very little work is being done; while Belgium is temporarily a German-run province, and its shipyards and engineering shops are being used for the manufacture of the munitions of war.

Great Britain is really the only country whose shipbuilding and shipping has actually benefited from a trade point of view by the war. Its activities, instead of being arrested, have been accentuated tenfold; and with almost all the world to draw upon for materials and to use as a market, its shipbuilding has more scope than ever. Its output in 1914, as will be seen from the following table, has not, however, been affected by the increased activity. There has not yet been time for the changed conditions to tell on statistical returns.

country or than any British river; but it may be taken as certain that she did not complete anything like the tonnage that was completed on the Clyde alone. Her unfinished vessels must be cumbering her wharves and fitting-out basins, while those of the United Kingdom are trading on all the world's great routes. It must also be remembered that, while her total includes warships, there are none of these vessels in the Clyde figures:

	Vessels.	Tons.	I.H.P.
United Kingdom	1294	1,722,154	1,359,904
Germany	184	505,719	572,653
The Clyde	307	460,258	496,120
The Tyne	91	315,896	196,465
Holland	674	278,584	115,106
The Wear	79	278,537	148,365
United States	156	270,962	306,465
The Tees	99	250,638	165,400
Ireland	23	246,370	186,890



NO. 1 FLOATING GRAIN ELEVATOR BUILT AND DELIVERED IN 1914 BY SMITH'S DOCK CO., MIDDLESBOROUGH, ENGLAND, FOR THE QUEBEC HARBOR COMMISSION.

Leading Mercantile Builders.

There is no dubiety about the identity of the firm which had the largest output of new tonnage in 1914. Messrs. Harland & Wolff's work is so much more than that of any other concern that it is nearly double the next highest—that of Messrs. Blohm & Voss, of Hamburg and Stettin.

In some previous years it may be remembered the question of tonnage measurement had to be discussed before precedence could be settled, and first place has depended more than once on the reduction of all tonnages to official measurements, but while the Belfast firm have an enormous tonnage to their credit it should be pointed out that this tonnage is the work of three yards, and that a small proportion of it was Clyde-built. However, it is all the work of one firm, and for such a purpose as the present must be reckoned as such. Besides, the firm's list of launches is extraordinarily interesting. It includes three of the six largest vessels of the year, as well as other notable vessels of very large size, and three motor ships launched at their Clyde works and engined at Glasgow. It is a record of work which has never been equalled by any firm in any country. The following tables show the first six firms in 1914, and the leading firms in each of the years back to 1890:

Company.	Vessels.	Tons.
Harland & Wolff	6	156,047
Blohm & Voss	4	83,499
Russell & Co.	15	78,016
Swan, Hunter & Wigham Richardson	16	70,446
William Gray & Co.	16	70,198
The Weser Co.	11	68,047

The following are the firms which have had the largest tonnages in the world since 1890:—

Year.	Company.	Tons.
1914	Harland & Wolff	156,047
1913	Armstrong, Whitworth & Co.	99,333
1912	Swan, Hunter & Wigham Richardson	121,281
1911	Harland & Wolff	118,209
1910	Harland & Wolff	115,861
1909	Workman, Clark & Co.	88,952
1908	Harland & Wolff	106,528
1907	Am. Shipbldg. Co. (7 yards)	191,602
	William Doxford & Sons	91,254
1906	Am. Shipbldg. Co. (6 yards)	193,535
	Swan, Hunter & Wigham Richardson	117,943
1905	Am. Shipbldg. Co. (7 yards)	136,793
	William Doxford & Sons	86,632
1904	Russell & Co.	73,689
1903	Am. Shipbldg. Co. (7 yards)	166,288
	Harland & Wolff	110,463
1902	Am. Shipbldg. Co. (7 yards)	132,197
	Harland & Wolff	79,497
1901	Harland & Wolff	92,310
1900	William Gray & Co.	74,191
1899	Harland & Wolff	82,634
1898	William Gray & Co.	72,323
1897	Harland & Wolff	82,240
1896	Harland & Wolff	81,310
1895	William Gray & Co.	66,086
1894	Harland & Wolff	65,448
1893	Harland & Wolff	65,660
1892	Harland & Wolff	68,612
1891	Harland & Wolff	64,962
1890	Russell & Co.	70,370

WORLD'S SHIPBUILDING AND MARINE ENGINEERING OUTPUT.

	1914.			1913.		
	Vessel.	Tons.	I.H.P.	Vessel.	Tons.	I.H.P.
England	817	966,839	639,654	912	1,100,321	756,945
Scotland	454	508,945	540,290	488	745,336	686,025
Ireland	23	246,370	186,890	24	131,916	113,590
United King. Totals.	1294	1,722,154	1,366,834	1424	1,977,573	1,556,560
Dominions	259	56,760	23,776	280	59,025	20,662
Foreign	1600	1,693,023	1,596,208	2186	1,947,958	2,245,277
Grand Totals	3153	3,471,937	2,986,819	3890	3,984,556	3,822,499

Output Comparisons.

After the United Kingdom itself, Germany has the largest output of new tonnage; that is, she launched a larger tonnage of new vessels than any other

The Leading Engineers.

It is interesting, to say the least, that in the year of the greatest of wars, German firms should have so much to their credit in the way of shipbuilding and marine engineering. Not only did they launch about half a dozen very large and very fine liners, but two of their firms have places in the first half-dozen, arranged according to horse-power produced. Of course, if all British horse-power could have been published, one at least of the two would have dropped out but, on the only figures which can be used, the position of the six leading firms are as follows:

Firm Name.	I.H.P.
The Vulcan Co.	154,000
Harland & Wolff	141,890
North-Eastern Marine Engineering Co.	112,580
William Cramp & Sons Co.	106,500
Denny & Co.	94,950
Blohm & Voss	88,000

The Leading Vessels.

In the first half-dozen vessels of the year Germany and Belfast again compete for supremacy. The competition indeed is confined to Germany and Belfast, no other part of the world having produced a vessel of 20,000 tons measurement. The vessels, all of which are now well known to those who take an interest in shipping and shipbuilding, are:

Vessel and Type.	Builders.	Tons.
Bismarck—4-scr. turb...	Blohm & Voss	56,000
Britannic—3-scr. comb.	Harland & Wolff	50,000
Statedam—3-scr. comb.	..Har. & Wolff	33,000
Belgenland—3-scr. comb.	..Har. & Wolff	27,000
Joh. Heinr Burchard—3-scr. comb.....	J. C. Tecklenborg	21,000
Wm. O'Swald—3-scr. comb.	The Weser Co.	20,000

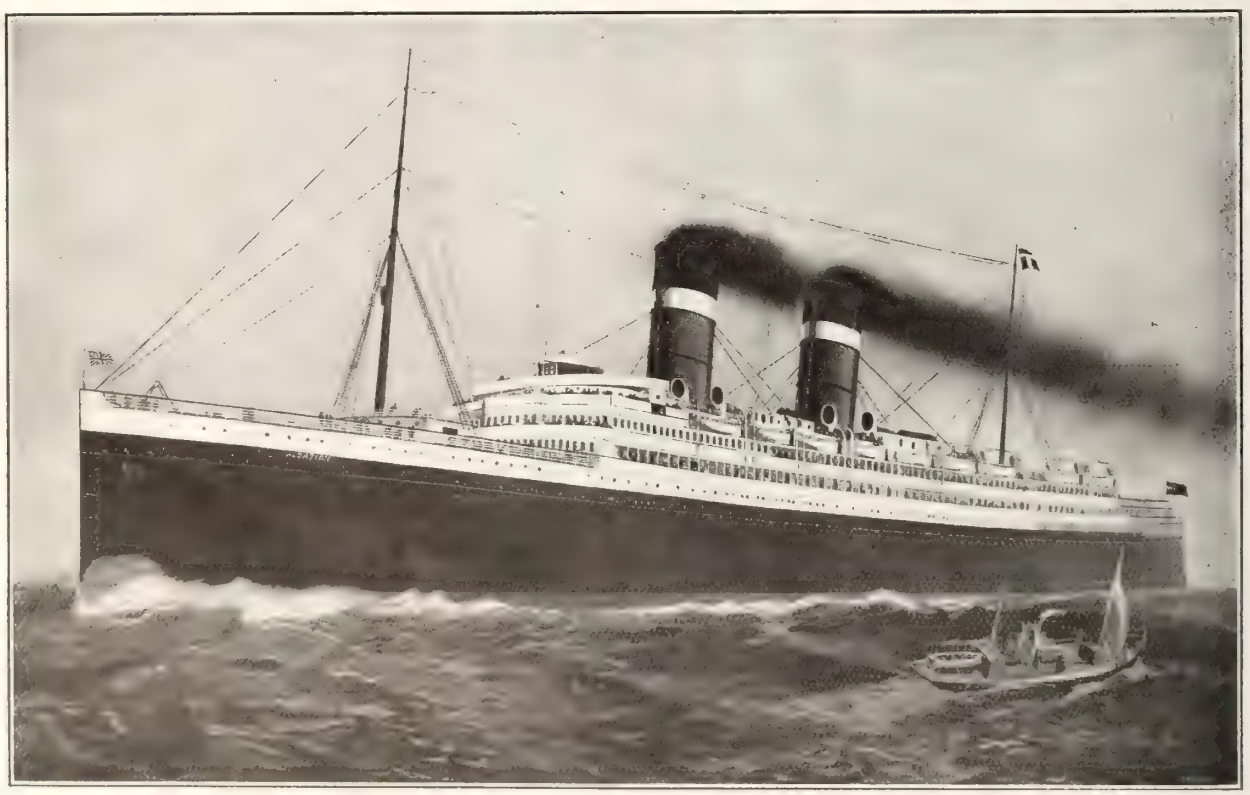
C.P.R. ATLANTIC LINERS "MISSANABIE" AND "METAGAMA," BUILT BY BARCLAY, CURLE & CO., GLASGOW, SCOTLAND, AND COMMISSIONED IN 1914.

Scottish Shipyards.

There was a large decrease in the output of new shipbuilding in Scotland, almost wholly, however, on the Clyde. On the East Coast the yards produced roughly about the same amount as in 1914. The following table shows the figures for the different districts.

OUTPUT OF SCOTTISH SHIPYARDS.

	—1914—			—1913—		
River District.	Vessel.	Tons.	I.H.P.	Vessel.	Tons.	I.H.P.
The Clyde	307	460,258	496,120	353	692,601	649,240
The Forth	18	19,733	9,440	23	19,519	7,355
The Tay	18	13,335	10,200	10	18,157	6,225
The Dee	111	15,619	24,530	102	15,059	23,205
Totals	454	508,945	540,290	488	745,336	686,025



ALLAN LINE ATLANTIC STEAMSHIPS "CALGARIAN" AND "ALSATIAN," BUILT BY THE FAIRFIELD SHIPBUILDING & ENGINEERING CO. AND WILLIAM BEARDMORE & CO., RESPECTIVELY, ON THE CLYDE, AND COMMISSIONED MIDSUMMER, 1914.

The Clyde District.

The year was more eventful on the Clyde than in any other shipbuilding district. To begin with, it had an enormous output of new tonnage in the previous year, so that there was scarcely any chance that it would maintain the record which was set up twelve months ago. The total production of 1913 consisted of 370 vessels of 756,976 tons, and 1,111,440 i.h.p. Nothing in any sense approaching this had been turned out on the river in any previous year, and it was generally recognized that high water mark had been reached and that all concerned might anticipate a falling off. The falling off came in due course.

From the beginning of the year right down to the eve of the war, the output was regularly lower over stated periods than had been that of 1913, and it was seen that—if this process continued—the ebb of the tide would be as marked as had been its flood, and that a period of depression was not very far off. New contracts were very scarce, and there was talk of organized plans for laying up unprofitable tonnage. It should be added that, in one sense, all this had very little local effect. Clyde builders had booked so many orders the year before that their supply of work did not run short, and only in one or two isolated instances did any of the firms find it necessary to dismiss men because of the lack of employment.

Thus the district was never really slack, although its volume of production was decreased. It was employing its usual number of men, but there was not so much pressure in the yards and little overtime or nightshift time was being worked, except on special contracts, and on some of the naval work. All concerned were doing their best to stave off the evil day as long as possible, and it was not anticipated that there would have been much unemployment before the middle of winter.

Importance of Naval Work.

The war changed everything. Perhaps it was coincidence, and perhaps it was simply the result of the importance of the Clyde as a shipbuilding district, but one of the first effects of the war was to convert three of the largest shipbuilding and engineering establishments into Government dockyards for the time being.

At Clydebank John Brown & Co. had launched no mercantile vessels previous to the outbreak of hostilities, and when war was declared they had necessarily to slow down work on all such vessels and to devote practically all their energies to the completion of the warships which they had on hand. At Dalmuir William Beardmore & Co. had launched one small mercantile steamer, while at Govan the Fairfield Co. had launched a vessel of somewhat similar size. It followed therefore that as all three firms were doing naval work they at once passed out of the ranks of Clyde mercantile shipbuilders, and although the two small vessels referred to are accounted for in the district and total returns, the names of the three firms must necessarily be omitted.

In the case of Yarrow & Co., Wm. Denny & Brothers, and Scotts' Shipbuilding Co., a certain proportion of the work of each firm was naval, and so does not appear, while a certain Government vessel of a non-naval type is omitted from the work of another firm. All this has reduced very greatly the tonnage credited to the Clyde, and made the falling off appear much more than it really is—that is, when comparisons are made with the total figures for 1913.

Warship Engineering.

Naval i.h.p. always counts for far more relatively in statistics than naval tonnage, because the horse-power of warships, particularly warships of the small fast type, bears such a very high relation to the tonnage, and, although nothing can be said about the details of the work, it may be indicated that if there had been no war several of the firms whose names do not appear at all would have had very high totals of i.h.p. to their credit. In one case, where important work has been done for a foreign Government, there would in all probability have been a record i.h.p.—certainly a total very much higher than anything which appears in the returns of this year.

All this emphasises the value of naval work to the district. In no other district is there more than one firm so exclusively devoted to naval construction that their names do not figure as shipbuilders this year. On the Tyne every firm is represented, although of course all their work is not given; but on the Clyde and in the West of Scotland generally the outbreak of war brought about something of a revolution. All the industrial machinery, from the coal pits in Lanarkshire to the building slips at Greenock, began to run noiselessly and rapidly with the one object—that of either doing national work or playing so into the hands of the firms who were doing such work that they could make the greatest possible expedition. One result of this was that while the naval yards became exceedingly busy the mercantile yards slackened off, and thus the output of general tonnage was still further reduced.

C.P.R. PACIFIC COAST STEAMSHIP "PRINCESS MARGARET." THIS VESSEL, ALONG WITH HER SISTER SHIP THE "PRINCESS IRENE," WERE BUILT BY WM. DENNY BROS., DUMBARTON, SCOTLAND, AND BOTH WENT INTO COMMISSION TOWARDS THE LATTER PART OF 1914 ON BRITISH ADMIRALTY SERVICE.

The Tonnage on Hand.

When the fortunes of the war turned in favor of the Allies a large number of contracts were placed by shipowners, and very soon there were again many mercantile orders on hand. Not only so, but there were fewer men to do the work and the mercantile firms, who had loyally "lent" men in generous numbers to the naval firms, found themselves unable to promise definite deliveries or to make anything like satisfactory progress with new work. This is the condition of the industry now.

According to the official figures compiled by the staff of Lloyd's Register there were under construction on the Clyde at the end of September, 146 vessels of 613,998 tons. This took into account only vessels actually laid down, so that the real total of work "on hand" would be considerably over that figure. Since then the total has been increased rather than decreased, and now there must be at least a full year's work on the books of most of the firms—totally irrespective of war vessels. In all the areas trade is good and everywhere the demand is for men.

The war has brought to the Clyde what would in normal circumstances have been called a shipbuilding boom. In present circumstances the "revival" is scarcely noticed, as the thoughts even of those closely connected with the work are about other things, while the general public are interested only in the war, but—whether it will last or be followed by a "slump"—the work is there meantime in quantities large enough to provide employment for all the shipyard and engine shop workers on military service, no matter how soon they return or in what numbers.

English Shipyards.

The mercantile production of English shipyards shows a very marked decrease as compared with last year and, as the returns from all the districts are thoroughly complete, the figures must be taken as indicating the exact relation of the industry in 1914 to that of 1913. It need hardly be pointed out, however, that the great falling off shown in the following table does not infer a corresponding amount of inactivity in the yards. The exclusion of warship work makes the figures misleading in many ways, as in some of the English districts very large proportions of the men have been engaged on such work, and are still so engaged—more busily than ever, indeed.

On the Tyne, on the Mersey, and at Barrow the naval firms would have had much larger figures to their credit but for the war, which has made them busier, but has also made it necessary that nothing should be said about what they have done or are doing. Even including naval work, however, there would have been decreases in most of the English districts—especially on the North-East Coast. There the falling off in freights was affecting shipbuilding considerably before the war began and would have affected it still more had the war not come to revive the demand for tonnage. As it is, there is a decrease all over England of 95 vessels ,133,482 tons and 117,291 i.h.p.

There are district decreases on the Tyne, the Wear, the Tees, the Mersey, the Thames, and the Bristol Channel, and slight increases on the Humber and in the English Channel area. The general tendency before the war was towards a period of depression, and the districts which depended principally on the construction of cargo steamers were looking forward to a spell of bad trade. Recently, however, many orders for cargo steamers have been placed on the North-East Coast, and nearly all the yards now have as much work as they can obtain men to carry on. The problem of labor is the most difficult which the builders everywhere have to face, and the lack of sufficient numbers of men is handicapping the firms in all the districts very heavily.

QUEBEC HARBOR COMMISSION TUG "LAVAL," BUILT BY SMITH'S DOCK CO., MIDDLESBOROUGH, ENGLAND, AND COMMISSIONED SEPTEMBER, 1914.

Irish Shipyards.

Of the two Belfast shipyards, one records a slight reduction of output, but the other was exceptionally busy, and the total for the country shows a very decided increase. Fuller reference is made elsewhere to the remarkable output of the Queen's Island yard.

OUTPUT OF IRISH SHIPYARDS.

Company.	1914. Vessels.	Tons.	I.H.P.	1913. Tons.	I.H.P.
Harland & Wolff	6	156,047	141,890	40,644	53,390
Workman, Clark & Co.	9	75,188	45,000	84,217	60,200
North of Ireland Co.	4	12,225	—	3,366	—
Dublin Dockyard Co.	2	2,637	—	3,453	—
The Larne Co.	2	273	—	180	—
Ross & Walpole	—	—	—	56	—
Totals	23	246,370	186,890	131,916	113,590

OUTPUT OF ENGLISH SHIPYARDS.

District.	1914. Vessels.	Tons.	I.H.P.	1913. Vessels.	Tons.	I.H.P.
The Tyne	91	315,896	196,465	97	360,842	201,482
The Wear	74	278,537	148,365	79	303,103	193,225
The Tees	99	250,638	165,400	95	307,496	187,428
Humber	117	55,574	60,601	106	52,073	60,957
Mersey	165	45,076	37,777	162	47,105	69,675
Thames	179	11,768	18,095	214	18,874	23,095
Eng. Chl.	72	5,983	12,756	121	4,503	15,362
Bristol Chl.	20	3,367	195	38	6,320	721
Totals	817	966,839	639,654	912	1,100,321	756,945

British Dominions.

In the far-flung but well-knit Dominions of the British Empire some interesting work was done during 1914. The steamer W. Grant Morden, built by the Western Drydock and Shipbuilding Co., at Port Arthur, Ont., is the largest purely bulk freighter in the world, but she is

followed closely by the Collingwood-built vessel J. H. G. Hagarty. None of the new British-Canadian yards has yet had any launches, but the Canadian Vickers Co., at Montreal, have an ice-breaker, dredger and several submarines under construction, the two former being for the Canadian Government and the latter for the British Government. Yarrow's, Ltd., Esquimalt, B.C., are now in excellent working trim, and during the past year have done a considerable amount of repair and overhaul work on vessels of all sizes.

OUTPUT OF BRITISH OVERSEAS DOMINIONS.

Company.	1914. Vessels.	Tons.	I.H.P.	1913. Tons.	I.H.P.
Western Drydock & Shipbldg. Co.	1	8,980		15,898	—
Collingwood Shipbuilding Co.	2	8,379	2,400	9,982	4,500
Burn & Co.	31	7,681	3,394	7,778	3,528
The Taikoo Co.	9	7,166	4,970	5,513	3,600
John King & Co.	69	4,780	160	5,687	254
The Shalimar Works	43	3,636	75	1,202	—
Hong Kong Whampoa Co.	15	3,197	4,695	3,304	4,580
Kwong Tack Cheong	4	2,350	2,995	—	—
W. S. Bailey & Co.	9	1,475	135	300	160
Singapore Dock Board	8	504	1,195	942	605
The United Engineers	11	456		514	85
Other Firms	57	8,156	3,757	7,905	3,350
	259	56,760	23,776	59,025	20,662

Vessels and Type.	Registry.	Tons.	I.H.P.
ALCOCK, ASHDOWN & CO., BOMBAY.			
12 vessels—Steel barges	Bombay	108	
D. C. MULHALL, LIVERPOOL, NOVA SCOTIA.			
3 vessels—Schooners	Not stated	870	
COQUITLAM SHIPBUILDING CO., COQUITLAM, B.C.			
Coquitlam City—Sail	Vancouver	933	—
DAVIE SHIPBUILDING & REPAIR CO., LEVIS, QUE.			
Progress—Steam ferry	Quebec	465	—
JOSEPH M'GILL, SHELBOURNE, NOVA SCOTIA.			
5 vessels—Schooners	Not stated	543	
POOLE & STEEL, SYDNEY, N.S.W.			
Dredger No. 19—Dredger	Australian Gov't.	450	500
E. WRIGHT, CAPE HAWKE, N.S.W.			
Narani—Twin-screw	Sydney	381	—
STEVENSON & COOK, PORT-CHALMERS, N.Z.			
Dunedin—T.s. tug	Dunedin	345	500
SINCENNES, MCNAUGHTEN CO., SOREL, QUE.			
4 vessels—Tugs	Canadian	336	—
A. W. SETTREE, BAWLEY POINT, N.S.W.			
Douglas Mawson—T.s.	Sydney	333	—
SOUTHERN SALVAGE CO., LIVERPOOL, N.S.			
Deliverance—Twin-screw	Liverpool	280	—
D. DRAKE, SYDNEY, N.S.W.			
Kedumba—Screw ferry	Sydney	320	—
Kurama—Screw ferry	Sydney	290	—
POLSON IRON WORKS, TORONTO, ONT.			
Cyclone—Dredger	Toronto	650	500
Scout—S.s.	Canadian Gov't.	333	450
C. BAILEY, JUNR., AUCKLAND, N.Z.			
Tiare Tapore—Aux. gas eng.	Papeete	171	—
Ngoiro—Steam barge	Auckland	204	—
J. ERNST & SON, MAHONE BAY, N.S.			
1 vessel—S.s.	Yarmouth, N.S.	50	—
Elsie Biroet—Schooner	Lunenburg	118	—
THOR IRONWORKS, TORONTO, ONT.			
La Salle—Steam yacht	Toronto	85	—
Emily E. Stewart—Steam tug	Toronto	106	—
Donald Mac—Fishing tug	Toronto	70	—
CENTRAL ENGINE WORKS, SINGAPORE.			
Djinn—Motor launch	Singapore	5	—
Ban Lie—Motor launch	Soengei Liat	15	—
10 vessels—Lighters	Malay States	80	
MORRISON & SINCLAIR, SYDNEY, N.S.W.			
Warringal—Screw ferry	Sydney	125	
Bodalla—Twin-screw	Sydney	240	—
Macleay River—Twin-screw	Sydney	250	—
KWONG TACK CHEONG, HONG KONG.			
Wing On—T.s. river	Hong Kong	900	1,400
Wa Sun—S.s. river	Hong Kong	300	275
Sing Cheong—T.s. river	Hong Kong	700	640
Ko Kwong—S.s. river	Hong Kong	450	680
W. S. BAILEY & CO., HONG KONG.			
Mong Dzuong—Screw tug	Hungary	60	135
Nu. Sra de la Paz—S.s.	Manila	1,000	—
4 vessels—Motor boats	Various	55	—
Erie—Motor lighter	Hong Kong	80	—
2 vessels—Oil lighters	Hong Kong	280	
UNITED ENGINEERS, SINGAPORE.			
Nekopema—S.s.	Batavia	121	—
Miri IV.—Motor lighter	Miri	59	—
1 vessel—Motor lighter	Singapore	75	—
5 vessels—Motor launches	Various	86	—
3 vessels—Towing lighters	Various	115	
SINGAPORE HARBOUR BOARD, SINGAPORE.			
Pitho—Twin-screw tug	Singapore	165	500
Agnes—T.S. water boat	Singapore	110	140
Angler—Steam launch	Singapore	50	180
Diana I.—Steam launch	Singapore	48	150
Shark—Steam launch	Singapore	53	125
Ethel—Shallow draft tug	Singapore	40	100
1 vessel—Steam launch	Singapore	3	—
Arrang—Lighter	Singapore	35	

BRITISH SHIPS AND FOREIGN REGISTER.

THE Order-in-Council prohibiting the transfer of British ships to foreign register unless a license for the purpose is obtained from the British Board of Trade may have no significance other than that the British Government wants to be assured that the transfers are legitimate, says The New York Maritime Register. "Nevertheless, it is in the power of the Board of Trade to refuse any or all applications for a transfer license.

"Great Britain is jealous of her commercial supremacy, and she is no doubt justified in adopting measures to prevent the transfer of her merchant vessels to foreign register in any considerable numbers. This order may retard the acquisition by purchase or otherwise of British vessels in the upbuilding of the U. S. merchant marine.

"The British Government already has taken into its service for war purposes a large number of its merchant vessels, and as the war continues it may be found necessary to greatly increase this fleet, and it would be only natural for Great Britain to take precautionary measures against the possibility of any of her merchant vessels that would be available as auxiliaries in her navy going under a foreign flag.

"As the acquisition by purchase of German ships interned in American seaports might lead to complications, the development of the U. S. merchant marine will hereafter experience but little impetus from these sources, and as the merchant vessels of other neutral nations are busily employed, it is not in this direction that the U. S. may look for any large increase in the number of its vessels in the oversea carrying trade.

"The situation precludes the possibility of any considerable addition to the American merchant marine by transfer, at least, of the vessels of other nations, and if the United States is to take a prominent place in the carrying trade of the world, something will have to be done to encourage the building in its own yards of ships for oversea trading."

C. P. R. Discontinues Ferry at Windsor.—Independent operation of car ferries across the Detroit River between Detroit and Windsor was discontinued by the C. P. R. on January 10. Under a new arrangement the car ferries Ontario, owned by the C. P. R., and the Pere Marquette No. 14, owned by the Pere Marquette Railroad, on and after January 10 will be operated under the joint control of the two railroads for both passenger and freight trains of each line, except the two fast passenger trains of the Canadian Pacific, running between Montreal and Chicago.

WESTERN DRYDOCK & SHIPBUILDING CO., PORT ARTHUR, ONT.

Vessels and Type.	Registry.	Tons.	I.H.P.
W. Grant Morden—Cargo	Port Arthur	8,980	

COLLINGWOOD SHIPBUILDING CO., COLLINGWOOD, ONT.

J. H. C. Hagarty—Cargo	Toronto	7,989	2,400
No. 43—Dump scow	Collingwood	390	

THE SHALIMAR WORKS, CALCUTTA.

Condor—Steam launch	Calcutta	28	75
42 vessels—Barges, lighters, etc.	Calcutta	3,608	

JOHN KING & CO., HOWRAH, INDIA.

2 vessels—Steam launches	Calcutta	120	160
4 vessels—Motors	Calcutta	180	
3 vessels—Ferryboats	Calcutta	90	
9 vessels—Flats, etc	Calcutta	1,605	
51 vessels—Cargo boats	Calcutta	2,785	

BURN & CO., HOWRAH, INDIA.

1 vessel—Paddle	Calcutta	241	560
3 vessels—Twin-screw	Calcutta	449	1,330
2 vessels—Twin-screw tugs	Calcutta	271	1,250
2 vessels—Motor launches	Calcutta	50	179
1 vessel—Suction dredger	Not stated	52	75
22 vessels—Barges, etc.	Not stated	6,618	

TAIKOO DOCKYARD, HONG KONG.

Tungchow—S.s.	Hong Kong	2,104	1,850
Chungking—S.s.	Hong Kong	2,171	1,400
Chekiang—S.s.	Hong Kong	2,171	1,400
Taikoo Mang—Steam launch	Hong Kong	33	150
Taikoo Lung—Steam launch	Hong Kong	59	170
4 vessels—Lighters	Hong Kong	628	

HONG KONG AND WHAMPOA DOCK CO.

Senang—Passenger	Bandjermasin	1,163	1,150
Cheong Keng—T.s. cruiser	Macco	130	450
Yeung Shing—T.s. cruiser	Canton	140	450
Tai Lee—T.s. river	Hong Kong	997	1,700
Tagawa Maru—St. launch	Hong Kong	36	100
C.B.—Steam launch	Hong Kong	28	80
Tomijima Maru—St. launch	Hong Kong	36	100
Gannet—Screw tug	Hong Kong	92	375
Tean Cheang—St. launch	Hong Kong	36	100
K 3—Steam launch	Hong Kong	28	80
Licorne—Steam tender	Hong Kong	36	110
Audacious—Motor schr.	Hong Kong	450	
3 vessels—Motor boats	Hong Kong	25	

DOTY ENGINEERING WORKS, GODERICH, ONT.

Vessels and Engines.	Builders of Vessels.	I.H.P.
Puncher—	Sincennes, Macnaughten	117
La Salle—	The Thor Iron Works	25
Donald Mac—	The Thor Iron Works	20

LA CIE, PONTBRIAND, SOREL, QUE.

Maria—Compound tug	Lemay, Quebec	85
Dick C.—Compound tug	J. A. C. Turestte, Que.	220
Edward G.—Compound tug	Sincennes, Macnaughten	230
Felica E.—Compound tug	Sincennes, Macnaughten Co.	660
Progress—Compound ferry	G. T. Davie, Quebec	450

United States.

American shipbuilders were busier than in 1913, but there were no particular developments in the industry. Among the more notable vessels are the pair of triple-screw turbine boats at Philadelphia for the Pacific coast passenger and freight service. The legislative changes and the opening of the Panama Canal have not yet had any appreciable effect on the shipbuilding of the country.

OUTPUT OF FOREIGN COUNTRIES

	1914.			1913.		
Country.	Vessel.	Tons.	I.H.P.	Vessel.	Tons.	I.H.P.
Germany	184	505,719	572,653	417	645,953	776,171
Holland	674	278,584	115,106	762	267,715	116,653
United States	156	270,962	306,465	216	265,589	265,385
France	98	196,540	203,630	146	263,928	287,216
Japan	164	136,309	125,614	212	124,624	202,984
Austria	28	78,457	58,300	66	75,021	171,450
Norway	67	54,108	39,555	72	50,071	41,318
Italy	54	41,792	35,455	66	89,671	223,390
Russia	14	33,976	61,000	47	44,614	62,082
Denmark	39	33,463	19,551	38	43,691	24,717
Spain	9	21,197	33,000	14	24,443	40,500
China	68	16,664	12,120	60	8,487	2,230
Sweden	29	14,637	13,760	40	22,080	21,181
Belgium	16	10,395	—	30	22,071	10,000
Totals	1600	1,693,023	1,596,209	2186	1,947,958	2,245,277

OUTPUT OF UNITED STATES SHIPYARDS.

	1914.			1913.	
Shipyard.	Vessels.	Tons.	I.H.P.	Tons.	I.H.P.
Dockyard vessel	1	7,200	5,200	465	1,750
New York S.B. Co.	9	44,905	48,450	35,391	33,500
Fore River Co.	7	41,084	47,700	6,811	18,650
Newport News Co.	11	38,987	15,500	53,238	27,850
Maryland Steel Co.	9	29,046	15,690	32,442	21,000
W. Cramp & Sons Co.	6	22,359	106,500	24,947	41,000
American S.B. Co.	5	21,929	9,050	25,485	18,000
Union Iron Works	8	20,252	13,800	3,808	2,625
Great Lakes Works	9	16,598	6,955	11,288	6,660
American Car Co.	16	10,451	—	10,400	—
Harlan & Hollingsworth	5	5,252	4,520	12,857	15,060
Craig Shipbuilding Co.	1	1,522	875	6,848	—
The Perth Amboy Co.	23	1,500	—	3,500	—
Staten Island Co.	5	1,345	3,800	3,482	6,000
Bath Ironworks	2	1,190	16,000	2,346	35,275
Johnston Brothers	5	1,077	—	—	—
The Seattle Co.	3	750	2,400	4,602	8,070
Other firms	31	5,515	975	25,195	13,290
New London Co.	—	—	6,900	—	—
W. & A. Fletcher Co.	—	—	1,600	1,300	13,100
United Eng. Works	—	—	550	1,184	3,555
Totals	156	270,962	306,465	265,589	265,385

Output of Foreign Countries.

Of the fourteen foreign countries in which shipbuilding is done, the figures for eight show decreased tonnages, while those for the other six show increases. On the total, however, there is a decided decrease, due largely to the inevitable reduction in the German figures. The German returns are very comprehensive, considering the circumstances; but they are not absolutely complete, and the tonnage missing would probably have wiped off part of the apparently adverse balance on that country's figures. All over, the returns show a foreign output of 1,600 vessels of 1,693,023 tons and 1,596,209 i.h.p., as compared with 2,186 vessels, 1,947,958 tons, and 2,245,277 i.h.p. in 1913. These figures indicate decreases of 585 vessels, 254,935 tons, and 649,068 i.h.p.

In Germany there is shown a decrease of about 140,000 tons, in Holland an increase of about 11,000 tons, in the United States an increase of about 5,000 tons, in France a decrease of about 67,000 tons, in Japan an increase of about 12,000 tons, in Austria—in spite of the war—an increase of about 2,500 tons, in Norway an increase of about 4,000 tons, in Italy a decrease of about 48,000 tons, in Russia a decrease of about 11,000 tons, in Denmark a decrease of 10,000 tons, in Spain a decrease of 3,000 tons, in China an increase of about 8,000 tons, in Sweden a decrease of about 7,500 tons, and in Belgium a decrease of about 12,000 tons. The accompanying table shows the work of the respective countries.

Dredge Launched at Welland—M. Beatty & Sons, Welland, Ont., launched a 20-inch hydraulic suction dredge from their yards on Dec. 7. The dredge which was ordered in June, is to be completed by the opening of navigation in the spring of 1915, and will cost about $150,000. The hull is 136 feet long, 42 feet wide and 11 feet deep. The craft has three Scotch marine boilers and triple expansion engines of 750 h.p. installed.

Canadian Rules for Steamship Life Saving Appliances

No Revision of Rules for Life-Saving Appliances Having Been made for Some Years by the Department of Marine and Fisheries, and Those at Present in Force Being Below the Standard Required by Other Governments as Regards Foreign Going Ships it Has Been Determined by a Recent Order-in-Council That the Rules Which Constitute the Substance of this Article Will Apply as From April 1, 1915.

GENERAL RULES II.

THE revision of the rules relating to life-saving appliances on steamships has been engaging the attention of the Department of Marine and Fisheries for some considerable time. The work, however, is now complete and, in the various details submitted, indicates that for foreign-going steamships the regulations are the same as those of the British Board of Trade and, for coasting and inland vessels, they are such as will ensure as high degree safety as is practicable. The first section of these rules will be found in our December 1914 issue.

6. *Number of persons.*

1. The number of persons which a lifeboat shall be deemed fit to carry shall be equal to the greatest whole number obtained by dividing the capacity of the boat in cubic feet, or the surface of the boat in square feet, as the case may be, calculated as provided by General Rules 7 and 8, by a standard unit of capacity, or unit of surface, defined below.

2. The cubic capacity in feet of a boat in which the number of persons is determined by the surface shall be assumed to be ten times the number of persons which the boat is authorized to carry.

3. The standard units of capacity and surface are as follows:—

Class of Lifeboat.	Unit of Capacity.
Class 1A	10
" 1B	9
" 3 (except for ships in Class III. Coasting or Inland)	10
" 3 (for ships in Class III., Coasting or Inland)	8

Class of Lifeboat.	Unit of Surface.
Class 2A) " 2C)	3½
" 1C) " 2B)	3¼

4. The Board may accept a smaller divisor for pontoon boats of Class 1C and Class 2B, if they are satisfied after trial that the number of persons for whom there is seating accommodation in the boat in question is greater than the number obtained by applying the above divisor, provided always that the divisor adopted in place of 3¼ shall never be less than 3.

5. The number of persons obtained by the above rules shall be reduced:—

(i) If it is greater than the number of persons for which there is proper seating accommodation, the latter number being determined in such a way that the persons when seated do not interfere in any way with the use of the oars, or,

(ii) If, in the case of boats other than open boats of Class 1, the freeboard when the boat is fully loaded is less than the freeboard required by these Rules.

6. If an Inspector is doubtful as to the number of persons any boat is fit to carry he may require it to be tested afloat with the intended number of persons on board.

7. The Board may limit the number of persons to be allowed in boats with very fine ends and in boats very full in form.

8. Two children under the age of twelve years may be carried in place of one adult person.

7. *Cubic capacity of Open Boats of Class 1.*

(1.) In the case of an open boat of Class 1 the cubic capacity shall be determined by the following formula:—

$$\text{Capacity} = \frac{L}{12} (4A+2B+4C.)$$

L denotes the length of the boat in feet from the inside of the planking or plating at the stem to the corresponding point at the stern post; in the case of a boat with a square stern the length is measured to the inside of the transom.

A, B, C denote respectively the areas of the cross-sections at the quarter length forward, amidships, and the quarter length aft, which correspond to the three points obtained by dividing L into four equal parts (the areas corresponding to the two ends of the boat are considered negligible).

The areas A, B, C shall be deemed to be given in square feet by the successive application of the following formula to each of the three cross-sections:—

$$\text{Area} = \frac{h}{12} (a+4b+2c+4d+e.)$$

h denotes the depth measured in feet inside the planking or plating from the keel to the level of the gunwale, or in certain cases, to a lower level as determined hereafter. a, b, c, d, e, denote the horizontal breadths of the boat measured in feet to the inside of the planking at the upper and lower points of the depth and at the three points obtained by dividing h into four equal parts (a and e being the breadths at the extreme points, and c at the middle point, of h).

(2) If the sheer of the gunwale, measured at the two points situated at a quarter of the length of the boat from the ends exceeds one per cent. of the length of the boat, the depth employed in calculating the area of the cross-sections A or C shall be deemed to be the depth amidships plus one per cent. of the length of the boat.

(3) If the depth of the boat amidships exceeds 45 per cent. of the breadth, the depth employed in calculating the area of the midship cross-section B shall be deemed to be equal to 45 per cent. of the breadth, and the depth employed in calculating the areas of the quarter length sections A and C shall be obtained by increasing this last figure by an amount equal to one per cent. of the length of the boat, provided that in no case shall the depths employed in the calculation exceed the actual depths at these points.

(4) If the depth of the boat is greater than 4 feet the number of persons given by the application of these General Rules shall be reduced in proportion to the ratio of 4 feet to the actual depth, until the boat has been tested afloat with that number of persons on board all wearing life-jackets, and the test has proved satisfactory.

(5) The cubic capacity of a boat may be assumed to be the product of the length, the breadth and the depth multiplied by 0.6 in cases where it is clear that this formula does not give a greater capacity than that obtained by the above method. The dimensions shall then be measured in the following manner:—

Length.—From the intersection of the outside of the planking with the stem to the corresponding point at the stern post or, in the case of a square sterned boat, to the after side of the transom.

Breadth.—From the outside of the planking at the point where the breadth of the boat is greatest.

Depth.—Amidships inside the planking from the keel to the level of the gunwale, but the depth used in calculating the cubic capacity may not in any case exceed 45 per cent. of the breadth.

In all cases the shipowner shall have the right to require that the cubic capacity of the boat shall be determined by exact measurement.

(6) If the oars are fitted in rowlocks, the bottom of the rowlock shall be considered as the gunwale in measuring the depth of the boat.

(7) The cubic capacity of a motor boat shall be obtained from the gross capacity by deducting a volume equal to that occupied by the motor and its accessories.

8. *Deck area and capacity of Pontoon Boats and Open Boats of Class 2.*

In the case of boats of the above types the surface in square feet shall be determined by the following formula:—

$$\text{Area} = \frac{L}{12}(2a+1.5b+4c+1.5+2e.)$$

L denotes the length in feet from the intersection of the outside of the planking with the stem to the corresponding point at the stern post.

a, b, c, d, e denote the horizontal breadths in feet outside the planking at the points obtained by dividing L into four equal parts and subdividing the foremost and aftermost parts into two equal parts (a and e being the breadths at the extreme subdivisions, c at the middle point of the length, and b and d at the intermediate points).

9. *Size of Boats.*

Except where specifically stated in these Rules, no boat carried in compliance with these Rules shall have a capacity of less than 125 cubic feet: Provided that the boats carried by ships in Class III, Coasting Trade or in Class III, Inland Trade, in accordance with the table in Appendix IV may be of a minimum capacity of 90 cubic feet. Provided also that small ships in Class IV, Coasting or Class IV, Inland Trade which trade or work only within sheltered waters or within short specified distances from such, may carry a boat of a minimum capacity of 50 cubic feet if the required accommodation is thereby supplied.

10. *Life-Rafts.*

(1) An approved raft shall satisfy the following conditions:—

(i) It shall be of such size, strength and weight that it can be handled without mechanical appliances, and, if necessary, be thrown from the vessel's deck.

(ii) It shall not have less than three cubic feet of air-cases properly constructed and protected, or equivalent buoyancy for each person whom it can accommodate.

(iii) It shall have a deck area of not less than four square feet for each person whom it can accommodate, and the platform shall not be less than six inches above the water level when the raft is loaded.

(iv) The air-cases or equivalent buoyancy shall be placed as near as possible to the sides of the raft.

(v) In addition to the foregoing an approved pontoon raft shall be reversible and fitted with bulwarks of wood, canvas or other suitable material on both sides. These bulwarks may be collapsible.

(2.) Every life-raft shall be marked to the satisfaction of the Board in such a way as plainly to indicate the number of persons for which it is approved.

(3.) Two children under the age of twelve years may be carried in place of one adult person.

(4.) In ships which carry rafts there shall be a sufficient number of rope ladders, or other approved appliances, always available for use in embarking the persons in the rafts.

11. *Weight of Persons.*

In the tests prescribed by these Rules for determining the number of persons which a boat or raft can accommodate each person shall be assumed to be an adult person wearing a lifejacket.

In verifications of freeboard the pontoon boats shall be loaded with a weight of at least 165 lb. for each adult person that the pontoon boat is authorized to carry.

12. *Stowage of Boats, Rafts, etc.*

(1.) All boats and rafts shall be stowed in such a way that—

(a) They can be launched in the shortest possible time;

(b) Even under conditions of list and trim unfavorable from the point of view of the handling of the boats and rafts as large a number of persons as possible can embark in them;

(c) As large a number of the boats and rafts as possible shall be capable of being launched on either side of the ship, either by means of approved appliances for transferring them from one side of the deck to the other, or by stowing some of the additional boats or rafts in rows across the deck, or by some other equally satisfactory means.

(2.) With regard to the stowage of additional lifeboats and rafts, the following provisions shall also apply:—

(a) Additional lifeboats may be stowed under lifeboats of Class 1 attached to davits;

(b) Additional lifeboats may be stowed in tiers of two or three one above another, or they may, subject to such conditions as the Board may impose, be fitted within one another;

(c) Additional lifeboats, and rafts, may be stowed in rows across a deck bridge or poop;

(d) Means shall be provided to the satisfaction of the Board for attaching additional lifeboats to the davits, and lowering them into the water, in the shortest possible time, and in the case of boats not stowed under davits for securing their transfer to the ship's side in the shortest possible time.

(3.) Where a boat is stowed underneath another boat there shall be provided approved removable supports or other approved appliances, so as to secure that the weight of a boat is not unduly supported by the boat underneath it.

(4.) Boats may only be stowed on more than one deck on condition that proper measures are taken to prevent the boats from a lower deck being fouled by those from a deck above.

(5.) All other buoyant apparatus, lifebuoys and life-jackets shall be so stowed as to be readily available in case of emergency.

13. *Appliances for Lowering Boats.*

(1) The davits shall be of approved form and shall be suitably placed to the satisfaction of the Board. They shall be fitted on one or more of the decks in such positions that the boats can be efficiently lowered from them, and shall be so spaced and placed that the boats can be swung out with facility. Davits shall not be fitted in the bows of a ship, but they may be fitted in any other position in the ship, provided that the boats are not brought in to dangerous proximity to a propeller at the time of launching.

(2.) The davits, falls, blocks and all other gear required for lowering the boats, shall be of sufficient strength, and of proper design to the satisfaction of the Board; and in the case of foreign-going passenger steamships launched on or after the 1st of April, 1915, they shall be of such strength that the boats can be lowered safely with the full complement of persons and equipment, the ship being assumed to have a list of 15 degrees.

(3.) In the case of foreign-going passenger steamships launched on or after the 1st of April, 1915, the davits shall be fitted with a gear of sufficient power to ensure that the boat can be turned out against the maximum list under which the lowering of the boats is possible on the vessel on which they are fitted.

(4) The boat's falls shall be long enough to lower the boat into the water with safety when the vessel is light. Life-lines shall be fitted to the davit spans, and shall be long enough to reach the water when the vessel is light. Hooks shall not be attached to the lower tackle blocks.

(5) Means shall be provided for speedily, but not necessarily simultaneously or automatically, detaching the boats from the falls; the boats placed under davits shall be attached to the falls and kept ready for service; the points of attachment of the boats to the falls shall be sufficiently away from the ends of the boats to ensure their being easily swung clear of the davits; the boat's chocks shall be of such construction and arrangement as shall be satisfactory to the Board.

PORT OF VICTORIA, B.C., IN 1914.

AS one of the coming ports on the Pacific, Victoria maintained its pace throughout the past year. Despite the depression in trade as a result of the European struggle, the port has secured a fair share of the legitimate shipping business that has filtered to that section of the coast.

The great harbor works which, when completed, will make Victoria one of the best equipped ports on the entire Pacific as regards dockage facilities, have been pushed forward with vigor, so that now the first signs of these gigantic undertakings are clearly visible above water.

It was inevitable that the war should cause some stagnation in shipping, and by reason of this the deep sea tonnage arriving during the last five months of the old year, was considerably affected.

Many Ships Commandeered.

With the commandeering of ships for scout and transport service by the Admiralty, the entire C. P. R. transpacific fleet was temporarily removed from the trade route between Victoria and ports in the Far East.

The Blue Funnel Line, the Royal Mail Steam Packet Co., and the Harrison Direct Line, all operators of big fleets of regular steamships to Victoria, were also materially affected by the wholesale requisitioning of ships for war purposes.

Despite all these handicaps the various shipping companies have maintained regular sailings where possible, and in some cases vessels have been chartered to fill in the gaps.

Important Developments.

Some important shipping developments occurred during the twelve months just closed.

The Blue Funnel Line inaugurated a new service of steamers between British ports and Victoria, via the Panama Canal, with the departure of the steamship Moyune from Glasgow on December 26. This service, coupled with the company's Oriental service, will give Victoria two Blue Funnel boats a month. With the advent of the Panama Canal faster services were immediately inaugurated by the Harrison Direct Line, the Danish East Asiatic Co. and the Maple Leaf Line.

The Hamburg-American Line has, naturally, been eliminated from the big shipping concerns maintaining services between European ports and Victoria.

To Benefit by Canal.

Other lines via the Panama Canal to Victoria are under consideration by shipping companies of the Old World. It is confidently anticipated that the Royal Mail Steam Packet Co. will start a regular service of steamships to the port, via the shorter route, before the new year is very much older. This great British line is planning an all-round-the-world service, with Victoria as the halfway house. The year 1914 saw no new steamships coming here in regular services.

The Canadian-Australasian Line, operators of the steamships Niagara and Makura between Sydney and Victoria, have under construction for this trade another large passenger vessel of approximately 14,000 tons register. She is being built on the Clyde by the Fairfield Shipbuilding Co., but the war has been responsible for some delay in bringing her to the launching stage.

For the coasting trade, the Canadian Pacific have completed at Dumbarton, by William Denny Brothers, the two palatial 5,000-ton coasting steamships Princess Margaret and Princess Irene, but the war is again responsible for delay in despatching these ships to Victoria for operation in the triangular service. The two Princesses were recently chartered by the Admiralty for service as scout cruisers.

Lumber Trade.

During the latter half of 1914 there was a big movement in lumber from Victoria and tributary ports. Many million feet of lumber were shipped to South Africa during the year, and many big parcels were taken out by regular liners for Great Britain and the Far East. Of the sailing ships that loaded, the principal vessels were the American barquentine Alta, the American schooner Inca, and the American ship Aryan, and the most recent Victoria fixtures include the Norwegian barque Wulff and the American barquentine Mahukona.

With the Genoa Bay Mills, operated by a Victoria concern, the largest single lumber order ever placed in British Columbia was secured last year. It was a shipment of 25,000,000 feet of lumber for the harbor improvements of Toronto, the order being placed with the Cameron Lumber Co.

The first big shipment of 5,000,000 feet was taken out by the Robert Dollar Steamship Co. vessel Robert Dollar, which sailed from Victoria on June 25 for New York. The second shipment of approximately 4,000,000 feet will be taken out early this season by the steamer Bessie Dollar.

EXAMINATION OF ENGINEERS, NFLD.

IN accordance with instructions received from the Imperial Board of Trade, on and after January 1, 1915, the Government of Newfoundland give notice through A. W. Piccott, Minister of Marine and Fisheries, that the qualifications as regards sea service required from candidates for certificates of competency as engineer in the mercantile marine will be as follows:—

(1)—A candidate for a second-class engineer's certificate will be required, in addition to the apprenticeship described in the regulations, or the alternative sea service, to have served eighteen months at sea as engineer or regular watch on the main engines or boilers of a foreign-going steamer of not less than 66 nominal horse-power; or twenty-seven months in a home trade steamer of not less than 66 nominal horse-power.

(2)—A candidate for a first-class engineer's certificate, in addition to the qualifications required from a candidate for a second-class engineer's certificate, must

(a)—Have served at sea for 18 months, with a second-class certificate of competency or service on regular watch on the main engines or boilers of a foreign going steamship of not less than 99 nominal horse-power as senior engineer in charge of the whole watch; or

(b)—Have served at sea for 27 months with a second-class certificate of competency or service as first engineer of a home trade steamer of not less than 99 nominal horse-power; or three years with a second-class certificate of competency or service as second engineer of a home trade steamer of not less than 99 nominal horse-power; or

(c)—Have served 3 years 9 months with a second-class certificate of competency or service as third engineer of a home trade steamer of not less than 99 nominal horse-power if during the entire period he has been senior engineer in charge of the whole of a watch on the main engines and boilers; or

(d)—Possess, or be entitled to, a first-class certificate of service.

Further information required by candidates may be obtained from the engineer examiners.

LACHINE CANAL WORK IN 1914.

IN connection with the Lachine Canal, $500,000 has been spent during 1914 to eliminate the curve, which proved dangerous to navigation at Cote St. Paul, and the new power house nearby will be completed next year. A larger intake at Cote St. Paul was finished this season. Above Cote St. Paul, a mile of new cement wharf has been built.

Shipping men have had reports from points all along the lake route from Fort William to Montreal last season for the first time, and this service will be extended during this year.

The Marconi Wireless Company intends to erect a new wireless station at Montreal next season and the Dominion Government will establish a new signal station at Cape St. Michel, three miles below Varennes.

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SHIPBUILDING A NATIONAL ASSET.

AS has been our wont in this first of the year issue, a comprehensive account is given of the world's shipbuilding and marine engineering output for the twelve months preceding, and we as Canadian citizens should no longer fail to note and profit by the significance of the statistics given, shedding light as they do on a feature of our industrial and commercial development which has been almost wholly ignored in the past. We form no insignificant unit in the constitution of the British Empire, and in many ways give indication to the world that in her achievements—peace and war time, we both emulate her and bear a part. We are also cognizant of many, if not all of the reasons why she merits almost world-wide admiration.

Setting aside the fact of her insular location, one prominent feature in Britain's business life has been so to establish and develop every known department of enterprise as to be able to give an equivalent return either in kind or service to those on whom she in numerous instances has had to be or is dependent. In the realm of shipbuilding and marine engineering, although at one and the same time a "Past and Present Grand Master," she has neither overlooked nor neglected other spheres of manufacturing or, more strictly speaking, other mechanical engineering enterprise, being in these respects at least a competitor worthy of the keenest. With the exception of Germany her meantime mortal enemy, no other nation has succeeded to any degree in approaching her in the dual accomplishment. Again, in the comparison with Germany, and in large part true also of other nations, Britain's attitude has been more largely co-operative and not so much competitive as these.

We in Canada are more insular in our business attitude than is Britain in her geographical location, and too often lose sight of the fact that to give the world what it wants and needs we should be in a position to not only produce and manufacture, but produce, manufacture and own the vessel transportation to deliver. Our crops are no doubt quite a substantial asset and, just because we have so chosen to make them, are of considerable importance to us nationally, but we are familiar enough with the fickleness of our climate, or should be so to realize, that crop failures are not uncommon. We have not hesitated to cater to railroad transportation nor to establish industries bearing on the latter, yet how little have we done to establish or stimulate water transportation industries within our borders or on our seaboards.

Our mineral wealth it is authoritatively stated is so unbounded that developments which have already taken place may be classed as mere surface scratches. There still lies hidden, we are told, across the length and breadth of this Dominion, the raw material with which we may yet become a first-ranker in the manufacturing world. We have chosen in the past, however, to stake our very existence on our crops, and have conformed our manufactures to that end. We have saddled and burdened our country with two transcontinental railroads whose revenues will not meet expenses in the next 25 years, or perhaps longer, unless we come to our senses soon, when proper regulation of the original railroad and its spur development would have sufficed. Had a fraction of the expenditure on these fool-hardy enterprises been given to the establishment and stimulating of shipbuilding and marine engineering with their myriad accessory industries, there would have been fewer iron and steel plants idle and semi-idle to-day and less unemployment of men and equipment.

It is highly significant of the ensuing navigation season outlook, that the Lake Carriers' Association at their recent annual meeting decided to delay the start of their vessel operations until June 1, and it is equally significant of the undesirable position in which the United States finds itself to-day that at least so far as its Government is concerned, it is out "flat-footed" to purchase all available vessels to build up its merchant marine. It has required this European War to bring home to that otherwise progressive country the fact that an outlet of their own is absolutely necessary to meet both ordinary and extraordinary contingencies, and that only by such an outlet being always available, will manufacturing be properly stimulated within its borders.

Canada owes equally as much to steamships as to railroads for her development, although in recent years her Government and her citizens have forgotten the fact. Her shipbuilding too was once a factor in the world's commerce, but was engulfed when railroads and wheat became enthroned.

MARINE NEWS FROM EVERY SOURCE

Montreal, Que.—One of the biggest pieces of insurance business handled in Canada has fallen to the firm of Marsh and McLennan, inc., of London, New York and Montreal. This is the risk—about $15,000,000 — covering the Canadian Pacific steamships on both Atlantic and Pacific routes.

Windsor, Ont.—Three veterans of the lakes, in the persons of Captain James Carney, Chief Engineer Alexander McDonald and Engineer Robert Craig, have retired and joined the superannuated list after serving the C.P.R. since the car ferry Ontario was placed in commission 25 years ago.

C. P. R. Steamship Names.—The two new steamships now building on the Clyde for the C. P. R., will be known as the Melita and the Medora, being named after two towns in Manitoba. The Melita will be delivered in July, and the Medora in October 1915, and both will go at once into the Atlantic service.

Ottawa, Ont.—Sir William Price and his fellow-members of the Quebec Harbor Board have been here to ask the advance of another $1,500,000 in order to complete the harbor works. They conferred with Hon. J. D. Hazen and other members of the Government, and received an assurance that the request would receive attention.

Ottawa, Ont.—There are many fully qualified marine engineers in different parts of Canada, some of whom have already offered their services to the British Navy. The Admiralty has just notified the Naval Service Department that these and any others who will offer will be accepted. They will be enlisted as artificer engineers for the period of the war.

Vancouver, B.C.—Canadian Pacific steamship officials have been notified that the two new steamers, the Princess Margaret and Princess Irene, just finished on the Clyde, have been taken by the Admiralty. The vessels are oil burners, with turbine engines, and have a speed of 23 knots. They were designed for service between Vancouver and Seattle.

Montreal, Que.—The White Star-Dominion Line has decided to merge the management of the Portland and Montreal offices, with John Torrance as manager and P. V. G. Mitchell as assistant manager, the appointments becoming effective January 1, 1915. The headquarters of the company will remain in Montreal. This reorganization is consequent on the death of Manager James Thom of Montreal, which occurred on November 26.

Steamship Earnings.—The earnings of the St. Lawrence and Chicago Steam Navigation Co., Limited, for the year ending 31st December, 1914, were $54,-639, which, with a balance brought forward of $222,150.57, and interest $4,-140.55 makes a total for distribution of $280,930.12. On the other side of the account the cost of management, $20,-768.57, and dividend of 3 per cent., $28,-992, absorbs $49,760.57, leaving a balance of $231,169.55.

Ottawa, Ont.—It is the intention of the Department of Marine to establish a uniform system of characteristic for gas-lighted buoys and gas beacons, making buoy or beacon lights that are to be left on the starboard side in going up stream occulting red lights, and port hand lights occulting white lights—that is, red buoys will carry red lights, and black buoys white lights. For special positions, such as middle grounds, and fairways, special arrangements will be made. White lights will, however, be favored when possible. It is proposed to make the changes on the opening of navigation or by May 1 next.

Marine Engineers and Navy.—At a meeting of the Toronto Branch, National Association of Marine Engineers the secretary was instructed to write to the Minister of Marine at Ottawa for information regarding the standing of Canadian marine engineers' certificates in the Imperial Navy, several of the members having signified their willingness to serve in the Imperial Navy if they can get their equivalent engine-room rating. Seeing that there is a call for trained men in this branch of the service several of the members are awaiting the reply with interest. Should there be any marine engineers interested they may apply to the secretary, N. A. M. E., 631 Gladstone Avenue, Toronto, for particulars.

Niagara Dredging Co has been incorporated at Toronto, Ont., with a capital of $40,000 to carry on a general dredging, contracting and engineering business at St. Catharines, Ont. Incorporators: J. S. Campbell, C. Bowman and H. M. Campbell, all of St. Catharines, Ont.

U. S Shipping Bill Must Pass.—President Wilson expects the Ship Purchase Bill to pass at the present session of Congress without material change. If not, he will call an extra session, it is declared, to pass the Bill and the appropriation measures.

Lakes Protective Association.—The Lakes Protective Association made a very good showing in 1914, which means underwriters had a profitable season, as the association carries 25 per cent. of the insurance on the bulk of the freighters that are insured. Not one of the 19 vessels lost last season was enrolled in the Protective Association, members of which operate about 200 vessels. Only one boat in a hundred was in an accident in which there was a total loss. The steamer Caldera sank the steamer W. H. Gilbert in Lake Huron. The heaviest loss to the underwriters was the steamer Benjamin Noble, which was insured for about $120,000. Her cargo of steel rails was also insured.

Charts of Inland Waters—The Naval Service Department, Ottawa, will shortly publish a complete Canadian issue of charts of the inland waters of the Dominion. A series of forty plates representing the result of several years of work already done, have been received from the Imperial authorities. The work of surveying the Great Lakes has hitherto been to a great extent done by the British Admiralty but, with the assistance of the results of its labors, the Canadian Government will now bring it much more nearly up to date. Two survey ships, La Canadienne, on Lake Superior, and the Bayfield, on Lake Ontario, are now engaged in surveying. Lake Ontario has been practically completed, and good progress has been made with the work on Lake Superior and Lake Huron.

Port Arthur Grain Shipments. — A statement has been issued by the Board of Grain Commissioners for Canada showing the quantities of each kind of grain shipped from Fort William and Port Arthur to Eastern ports during the season of navigation of 1914. The totals of the figures are as follows: To Canadian ports: Wheat, 82,693,918 bushels; oats, 22,297,226.24 bushels; barley, 4,026,586.46 bushels; flax, 1,118,240.36 bushels; rye, 1,051.06 bushels. Pounds of mixed grain, 19,415,702; elevator tons, 2,728; pounds of screenings, 1,500. To United States ports: Wheat, 25,009,152 bushels; oats, 2,665,883.12; barley, 1,069,595.19; flax, 6,455,415.12; rye, nil. Pounds of mixed grain, 148,710; elevator tons, 79,864; pounds of screenings, 1,185.

The Suez Canal.—Since 1896 something like $10,000,000 has been expended upon the widening and improvement of the Suez Canal. When first opened, the channel had a uniform depth of 25 ft. It is now 31 ft. deep, 108 ft. wide at the bottom, and 420 ft. at the water level. It is still being deepened and widened. Quite apart from this work, a whole fleet of dredgers is continually engaged on merely keeping the channel free from sand. We get some idea of the magnitude of this task when it is stated that last year over 2,000,000 cubic yards of material were taken out of the canal by these dredgers. Despite the heavy cost entailed in running the waterway and keeping it open for traffic, the scheme has almost from the first been a financial success, and Suez Canal shares are always much sought after. By the purchase in 1875, for some $20,000,000, of the 176,602 $100 original shares held by the Khedive, the British Government obtained joint control over the canal with France.

PORT OF MONTREAL BUSINESS IN 1914.

WAR, the alteration in a night of the conditions under which ocean travel and traffic could take place, and the remarkable measures taken by many men in many lands, and their governments, to meet the changed conditions, have made memorable a year that has nowhere shown its unusual features more patently than in the port of Montreal. In spite of the financial depression and the war, the year for the port has been a banner one in the amount of tonnage that came to it from the ocean, and the amount of grain that passed through it on its way to consumers overseas. Decreased Customs receipts showed a great diminution in imports, and the smaller number of men employed on the water front was evidence of the small amount of package freight exported until the war gifts and exports for military purposes relieved the situation.

Tramp Steamer Increase.

While there were fewer visits of the large ocean liners to the port on this account, the tramp steamers came in larger numbers than had been anticipated for years to come. On the 21st of August there were as many as forty-six ocean-going vessels in the port of Montreal, and for two months following the outbreak of the war there was an average of 40 in the harbor. For a time the situation was such that on account of the difficulties of exchange and the high rates of war risks, vessels other than regular liners would not leave the harbor. All the others had to remain until the situation adjusted itself, until owners and shippers were communicated with, and until it became evident who had command of the sea.

Altogether 916 vessels visited the port, excluding a number of pleasure steamers which came up. Of these, 551 were ocean-going vessels, with a tonnage of 2,039,133, and 365 came from the Lower Provinces, the latter having a tonnage of 720,229. This total of 916 vessels, with a tonnage of 2,759,362, compares favorably with 1913, when 820 boats with a tonnage of 2,690,535, visited the harbor. The largest number ever in the port on any former occasion was on June 8th, 1903, when 33 were in the harbor.

ISHERWOOD SYSTEM OF SHIP CONSTRUCTION.

THE Isherwood system of ship construction during the year 1914 has again made marked progress. The total number of ships now built and being built is 315, with an aggregate gross tonnage of about 1,480,983, while the total number of vessels launched during the past year was 45, representing about 274,990 gross register tons. That this system can be applied with advantage to all classes of vessels is evidenced by the following analysis of the boats already built and now on the way:—

Type.	Total.	Gross Tons.
Cargo vessels	129	574,337
Oil tank	125	666,180
Colliers	20	119,238
Passenger vessels .	9	27,769
Great Lake freighters	13	83,873
Barges	16	8,206
Dredgers	2	760
Trawlers	1	570
	315	1,480,933

The most notable vessels built during the year include five more huge oil tankers of the 15,000 tons d.w. type, three more large freighters for the American Lake trade, and special interest also attaches to the W. Grant Morden, built on the Canadian Lakes, as this vessel is probably the largest bulk freighter at present afloat throughout the world. With the addition of this vessel, the Isherwood fleet has now the distinction of including the largest oil tank vessel and cargo vessel afloat.

Vessels have been constructed to the highest classification of Lloyd's Register, British Corporation, Bureau Veritas, Germanischer Lloyd, Norske Veritas, and American Bureau, and the system has, for certain classes of vessels, been adopted by the Governments of Great Britain, United States of America, Italy, Russia, and France.

MONTREAL CUSTOMS RETURNS.

A decrease of $6,473,099.29 was shown in the customs collections of the Port of Montreal for the present year, as compared with those of last year. While these figures are itemized finely, they have been estimated for the final three days of this year, but it is reckoned by R. S. White, Collector of Customs, that they are practically correct.

This is the first really big decrease in collections that has been shown by the Port of Montreal for many years. While the drop was steady, it showed a tendency to increase, the reduction during the past three months having been greater than during the earlier months of the year.

While the shrinkage in collections is very considerable, amounting to over $500,000 a month, it is not in itself a very serious thing, since it covers a large proportion of the trade of the Dominion. It really means that things have been thrown back to about where they were three years ago, when prosperity was in the air. The collections were about $5,000,000 less than those of 1912, and practically equal to those of 1911, while they were much in advance of the returns for previous years.

The reduction has naturally been attributed to the war, but it is stated that the present belligerent condition in Europe could not be altogether blamed for it, since the drop really began in the fall of 1913, long before anyone dreamed of the present troubles.

In July, 1913, Mr. White reported the greatest customs collections for any month ever taken in Montreal, amounting to $2,529,211. From that time the collections began to drop, until by November, 1913, they showed decreases from the monthly figures for 1912. During the present year they showed a steady tendency to shrink, until by August, the month in which war was declared, they only amounted to $1,941,356, while by December they had dropped to $1,300,000. The lowest month of the year, and

the lowest for many years, was October just past, when the collections only amounted to $1,229,438, not far from $1,000,000 less than for the same month of the preceding year.

Following is a comparative statement of the Customs collections at the Port of Montreal during the present year and 1913:

	1913.	1914.
Jan.	$2,097,181.22	$1.669,455.97
Feb.	2,036,478.99	1,674,816.99
March	2,245,650.49	1,729,949.03
April	2,113,086.72	1,571,255.19
May	2,396,076.60	2,012,153.47
June	2,334,887.46	1,820,282.94
July	2,529,211.19	1,787,232.26
Aug.	2,269,669.37	1,941,356.30
Sept.	2,133,701.42	1,510,630.53
Oct.	2,147,810.93	1.229,438.94
Nov.	1,909,077.35	1,317,616.37
Dec.	1,824,455.54	*1,300,000.00
Total	$26,037,287.28	$19,546,187.99
Decrease in 1914		$6,473,099.29

*Estimated.

CAN GET SHIPS EASILY.

SO confident are President Wilson and Secretary of the Treasury McAdoo, that the Administration's Ship Purchase Bill will be passed, that B. N. Baker, of Baltimore, formerly at the head of a shipping company, but now retired, has been authorized to secure options on foreign vessels, available for purchase by this Government. Mr. Baker has advised with the Cabinet officers at each stage of the proposed shipping legislation.

Mr. Baker's correspondence on behalf of his Government has been included with a mass of letters bearing on the need for immediate relief for ocean shippers, which are being prepared for submission to Congress. No overtures have, however, been made to any of the German shipping companies looking to the acquisition of vessels now interned at various American ports. A member of the Cabinet states that, so far as he knows, none of the German ships are for sale, but in view of the unsatisfactory correspondence over the Dacia case, it is not likely that the Government will invest in vessels which have been flying the German flag unless Great Britain changes her attitude toward such purchases.

One of the strongest objections offered in Congress to the President's ship-purchase scheme has been that it would not add a single ship to those now in the trans-oceanic service. Government officials back of the pending legislation say that it would be possible to turn out a number of vessels capable of carrying freight in from six to nine months. In the meantime Mr. Baker's correspondence will be cited to prove that there are ships suitable for purchase that can be obtained on short notice.

On December 24, Mr. Baker telegraphed the Secretary of the Treasury as follows: "Have a cable from London this morning offering four new steamers immediate delivery, one 12,000, two 11,000, and one 8,000 tons, dead weight capacity, basis of $40 a ton, and guaranteed delivery within six months at same basis; all English or French built or building now, so there would be no difficulty in securing any amount of tonnage." In addition Mr. Baker had a cable from a London agent offering several ships.

1914 A LEAN YEAR FOR VESSEL OWNERS.

THE Great Lakes Protective Association, in annual session at Detroit, on January 22, decided not to increase its share of insurance risk upon vessels owned by members of the association, unless future developments in the European war made such action necessary.

The association furnishes 25 per cent. of this insurance, and foreign companies are prominently represented among the underwriters who insure the association's vessels for the other 75 per cent. Marine men argued before the convention that the percentage of loss has been so small that the association should increase its share of the risk to 50 per cent. A majority of the members voted, however, to make no change at present unless conditions abroad make it advisable to reduce the amount of insurance given to foreign underwriters. The advisory committee was authorized to watch developments in Europe, and to call a meeting of the association whenever it is thought advisable to change the insurance system. The 1914 advisory committee was re-elected, and the officers of the association will be chosen at a later date by the committee.

The year 1914 was a lean one for Great Lakes vessel owners, due to reduction in the ore movement which showed a decrease of 34 per cent. from that of 1913, according to the report of William Livingstone, president of the Lake Carriers' Association. Besides the lack of business, 54 sailors lost their lives in shipwrecks, which was "a rather high average," in the words of the president. Twenty-five vessels were lost during the season.

NO VESSELS UNTIL JUNE.

ON his return from Detroit, where he attended the annual meeting of the Lake Carriers' Association, Frank Peterson said the chief subjects discussed were insurance, and the probable date when vessels would be placed in commission this year.

It was pointed out by vessel owners from all parts of the Great Lakes that last year's sailing earnings were much below the pear previous, in fact in some cases the business never was so bad. The Association decided that no vessels would be placed in commission for the sailing year of 1915 until June 1, because inasmuch as there is only a certain amount of tonnage to haul by shortening up the season, it will divide the work up and make it profitable for all. It will also have a tendency to keep the rates up. "If," said Mr. Peterson, "we start a lot of vessels out in the spring with nothing to do, it brings the rates down and finally there is nothing for anyone to do."

Mr. Peterson stated that the convention was attended by 350 vessel owners and was the largest in the history of the Lake Carriers' Association.

CANADIAN VICKERS' WAR ORDERS

INFORMATION that the Canadian Vickers Co., Montreal, is executing important orders for war material for the British Government has leaked out through American sources and, in view of this, the statement has been made that the keels for eight first-class craft of the submarine class have already been laid down, and it is expected that several will be ready by August next.

That not only submarines but other important war materials are being made by the Vickers Company has been known in inside circles for some time, and the statement that these orders have nothing to do with the recent visit to Montreal of C. M. Schwab, can be repeated at this time on the authority of the officials of the company, who advise that any and all work being done at the Montreal plant is on the initiative of the company.

OPPOSE U.S. GOVERNMENT-CONTROLLED SHIPS.

FREIGHT steamships under Government control, as proposed by the Alexander bill, were formally opposed by the New York Chamber of Commerce at a special meeting held on Jan. 14, to consider the report of a special committee on the American merchant marine. The chamber unanimously voted to accept the report, which was unfavorable to the Alexander bill.

The proposal of the committee, however, that a fund of $30,000,000 be established as a guarantee for bonds issued against steamship property, did not meet with such general favor. The sum stipulated in this proposal is the same as that considered for the establishment of Government lines under the pending bill. This part of the report was sent back for further consideration.

MONTREAL HARBOR WORK, 1914.

ABOUT two million dollars was expended by the Harbor Commission during 1914 in dredging, renovating piers and wharves, building new sheds and wharves, and other work incident to the five-year programme of development undertaken by them at a total cost of fifteen million dollars.

The main dredging in the harbor was south of St. Helen's Island to a depth of twenty feet. The renovation of Victoria Pier and the old low wharves east of it has been continued with the ultimate object of completing 2,700 feet of new high level and 4,800 feet of low level wharves. This will provide new berths for small river boats opposite Bonsecours Market, and for ocean steamers just below shed sixteen and in the neighborhood of the two new steel and concrete sheds which have just been completed, at a cost of about $400,000. Similar sheds will be built parallel to the current on the new Victoria Pier where a stretch of 1,800 feet of dock is completed.

The $15,000,000 programme for five years includes a new warehousing system, the electrification of the railway system and the extension of the tracks from Racine Pier to Point aux Trembles, and ultimately to Bout de L'Isle. The Canada Cement and the Armstrong, Whitworth Companies have had wharves built last year.

SUBMARINES IN THE WORLD'S NAVIES.

THE following is an approximate list of the number of submarines possessed by the various countries:

	Built.	Building.
Great Britain	75-80	16
Germany	35-40	12
France	70-75	12-20
United States	40	15
Italy	19	7
Japan	15	2
Denmark	8	4
Holland	10	2
Sweden	7	3
Norway	2	3
Greece	2	1
Brazil	..	3
Chili	2	..
Peru	2	..

Season for Summer Deckloads—The Marine Department, acting in line with the British Board of Trade, is relaxing the summer deckload rules for ocean-going ships. The summer deckload has not been permitted in English ports until April 16, but will now be allowed on vessels ariving after March 30. Vessels will accordingly be allowed to leave Canadian ports for the United Kingdom with summer deckloads after March 1 in the case of sailing vessels, and March 12 in the case of steamers. The Canadian Government, however, takes no responsibility in the case of a Canadian ship arriving in England before the open season.

ADMIRALTY APPRECIATES SERVICE BEING RENDERED.

WE are glad to put on record the following letter which the British Admiralty has recently written to the British shipbuilding yards and engineering firms. The letter reads as follows:

> "Gentlemen,—I am commanded by my Lords Commissioners of the Admiralty to acquaint you that they have noted with great satisfaction the strenuous efforts which have been made since the outbreak of war to press on with the work for the Navy which has been entrusted to the various shipbuilding and engineering firms of this country, and they desire me to send their hearty congratulations upon the excellent results which have already been achieved.
>
> "I am to ask you to bring this letter to the notice of all your staff and employees, and to assure them, in the name of the Admiralty, that their patriotic efforts have assisted materially in increasing the strength and readiness of the Fleet.
>
> "It is their Lordships' earnest wish that each worker should realize that, however small his own work may seem, it is still an essential part of a great united effort, and that by steadfast devotion to his duty he is taking his part in maintaining his country's honor and safety just as surely as those who are engaged on active service.
>
> "Continued sacrifices and efforts are still required from all concerned if we are to sustain our soldiers at the front and our sailors affoat, and come through this business with **honour**, without misadventure.
>
> (Sgd.) W. Graham Greene."

Book Reviews

Syren and Shipping of date January 6, gives a remarkably complete synopsis of the happenings of 1914 as well as making a convincing analysis of the net results of the development of the shipbuilding and shipping business in all its phases during the same time. Every article is written by an expert in his branch. The war figures largely throughout the 156 pages of reading matter and 104 pages of solid advertising which make up this number, and its real effect on shipping, freights, insurance, coal and naval arrangements is demonstrated by highly illuminating statistics. It is a valuable number in every sense of the term.

Naval Recognition Book, by Fred. T. Jane, 73 pages, 7¼ in. x 5 in., with maps and illustrations. Published by Sampson Low, Marston & Co., London, England. The secondary title of this book, "Silhouettes of British Fighting Ships," more clearly explains the style and purpose of publication, for it is by the silhouette or profile of a warship that it's class can be identified at sea. It may not be out of place to state that warships are built and designated in classes; the number in each class varies, of course, as do also the different classes of ships as regards some feature in design and arrangement of guns. This is the second edition, and the author is a recognized authority on naval matters. A book of this description, at such a time as this, is of more than ordinary interest, for although there are many who have not and may not have the opportunity of seeing any of the ships comprising the British Navy, the fortunes of each ship will be followed with interest during the present war. Silhouettes of war vessels in each class are given, together with the names, displacement, speed and armament. The Dreadnought classes take premier place, followed by all other types of war vessels, such as cruisers, torpedo boats, etc., down to depot ships. Several pages are devoted to silhouettes of British liners of 18 knots or over. The ships are classified according to the number of funnels and masts, while the speed and owner's name are given for each. Other matter inincludes several maps of important British naval bases, details of officers' uniforms, and specimens of British flags. The index, while rendering the usual service, incidentally consists of an alphabetical list of all the ships in the navy: an interesting feature in itself. This manual, although a cheap edition, will be of assistance to officers and men of all ranks in the navy or mercantile marine. It will also be of interest to the general public, especially at this time when the name of each ship should be known to everybody. A companion book to this and by the same author deals with the German navy in the same manner. Copies may be obtained for 40 cents, post free, from the publishers of Marine Engineering, 143-153 University Avenue, Toronto.

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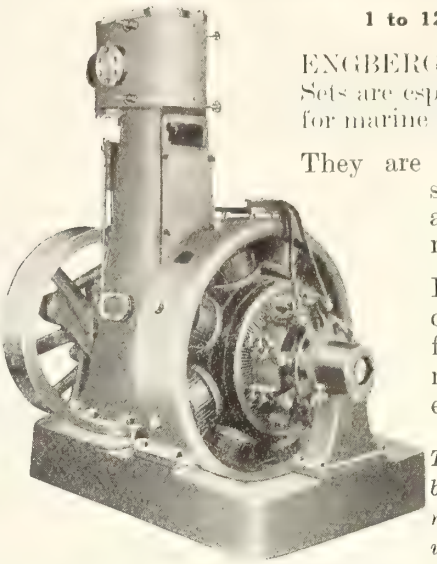

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ASSOCIATION AND PERSONAL

A Monthly Record of Current Association News and of Individuals Who Have Been More or Less Prominent in Marine Circles

Capt. Gideon Adams, of the Government steamer Reserve was accidentally drowned at Prescott, Ont., on Jan. 16.

Col. A. C. Labelle and Farquhar Robertson, Harbor Commissioners of Montreal, recently visited and inspected the harbor works at St. John, N.B.

John C. Newman, a director of Canada Steamship Lines and other important Montreal concerns, is again able to be at his office, after a severe illness.

George Joseph Desbarats, Deputy Minister and Comptroller of Naval Service, and formerly Deputy Minister of Marine and Fisheries, has been made a C.M.G.

A. F. Yarrow recently gave the 2,500 employees of Yarrow & Co., Scotstoun, on the Clyde, Scotland, a new ten-shilling note ($2.50) each as a gift in recognition of the energy displayed in the completion of several vessels.

John A. Murphy, chief engineer of the S.S. Glenfinnan, was accidentally killed on board that vessel on Christmas Eve, at Midland, Ont., while engaged overhauling her engines preparatory to laying up for the season. From particulars to hand, deceased had been taking down the connecting rod of the low pressure engine, when the hoisting tackle gave way, the falling rod crushing him against the framing. Mr. Murphy was secretary of Council No. 12, Midland, National Association of Marine Engineers, and to the bereaved family his confreres were unstinting in extending sincere sympathy because of his seemingly untimely end.

Thomas J. S. Milne, a prominent citizen of Kingston, Ont., and a well-known marine engineer, passed away early in December after an illness extending over five months. The deceased was sixty-five years of age, and was born at Glenburnie, of Scotch parents. His father was an engineer of note and from him the deceased inherited considerable of his skill. The late Mr. Milne received his early education at the Normal school, Montreal, and in the year 1864 he began his apprenticeship at the Canadian Locomotive works, Kingston. His engineering career practically started in 1868, on his taking over the position of assistant engineer on the Government S.S. Napoleon III. During the years 1878-80 Mr. Milne was engineer on various steamers, sailing between New York and the West Indies for the Quebec and Gulf Ports Steamship Co. In 1888 he superintended the building of the steamer Kathleen and was her engineer for two years after. The Norseman, North King, Alma Munro, Melbourne and Alexandria are other vessels upon which the deceased was engineer.

LICENSED PILOTS.

ST. LAWRENCE RIVER.

Captain Walter Collins, 43 Main Street, Kingston, Ont.; Captain M. McDonald, River Hotel, Kingston, Ont.; Captain Charles J. Martin, 13 Balaclava Street, Kingston, Ont.; Captain T. J. Murphy, 11 William Street, Kingston, Ont.

ST. LAWRENCE RIVER, BAY OF QUINTE, AND MURRAY CANAL.

Captain James Murray, 106 Clergy Street, Kingston, Ont.; Capt. James H. Martin, 259 Johnston Street, Kingston, Ont.; John Corkery, 17 Rideau Street, Kingston, Ont.; Captain Daniel H. Mills, 272 University Avenue, Kingston, Ont.

ASSOCIATIONS

DOMINION MARINE ASSOCIATION.

President — L. C. Henderson, Montreal.
Counsel—F. King, Kingston, Ont.

GREAT LAKES AND ST. LAWRENCE RIVER RATE COMMITTEE.

Chairman—W. F. Herman, Cleveland, Ohio.
Secretary—Jas. Morrison, Montreal.

INTERNATIONAL WATER LINES PASSENGER ASSOCIATION.

President—O. H. Taylor, New York.
Secretary—M. R. Nelson, 1184 Broadway, New York.

THE SHIPPING FEDERATION OF CANADA

President—Andrew A. Allan, Montreal; **Manager and Secretary**—T. Robb, 218 Board of Trade, Montreal; **Treasurer**, J. R. Binning, Montreal.

GRAND COUNCIL, N.A.M.E. OFFICERS.

L. B. Cronk, Windsor, Ont., Grand President.
A. F. Hamelin, Montreal, Que., Grand Vice-President.
Neil J. Morrison, P. O. Box 238, St. John, N.B., Grand Secretary-Treasurer.
E. Read, Vancouver, B.C., Grand Conductor.
A. J. Ross, Halifax, N.S., Grand Doorkeeper.
James Gillie and A. E. Kennedy, Kingston, Ont., Grand Auditors

St. John, N.B., No. 2, N.A.M.E.—The following officers have been elected by St. John, N.B., No. 2, National Association of Marine Engineers, for the present year:—

President—G. J. McVicar, 49 Winslow Street, Carleton.

First Vice-president—H. E. McCain, 59 High Street, St. John, N.B.

Second Vice-president—H. Phippen, 42 Broad Street, St. John, N.B.

Secretary—G. T. G. Blewett, 26 Murray Street, St. John, N.B.

Assistant Secretary—J. H. Hayter, 106 Dorchester Street, St. John, N.B.

Treasurer—W. B. Parks, Duke Street Extension, Carleton.

Conductor—W. J. Gorman, 236 Main Street, St. John, N.B.

Doorkeeper—F. H. Pitt, Moore Street, St. John, N.B.

Auditors—Bros. N. J. Morrison and W. L. Hurder.

Germany's Naval Pocket Book for 1915, just published, shows obvious signs of having been heavily "censored," for copies received deal only with the fleets of enemies and those of neutral powers, and say nothing of the German fleet. Not a single word is said as to the German losses, new, building, or old ships, while all the books of other years included a complete list, with all particulars of the German navy.

1915 Directory of Subordinate Councils, National Association of Marine Engineers.

Name.	No.	President.	Address.	Secretary.	Address.
[illegible]	1	Chas. M. Arnott.	94 Hanley Street,	A. J. Fisher,	641 Bathurst St., Toronto.
St. John,	2	G. J. McVicar	49 Winslow St., Carleton	G. T. G. Blewett.	36 Murray St., St. John, N.B.
Collingwood,	3	W. T. Rennie,	Collingwood.	Robert McQuade,	P. O. Box 97, Collingwood.
Kingston,	4	S. M. Murray,	20 Rideau St.,	James Gillie,	101 Clergy St., Kingston, Ont.
Montreal,	5	A. F. Hamelin,	3210 Le Tang Street,	O. L. Marchand,	2378 Clark St., St. Vincent de Paul, P.Q.
Victoria,	6	John E. Jeffcott,	Esquimault.	Peter Gordon,	808 Bianchard St., Victoria, B.C.
Vancouver,	7	Andrew T. Roy,	2812 18th Ave., W.,	E. Read,	Room 8, Jones Bldg., Vancouver, B.C.
Levis,	8	Michael Latulippe,	Luzon,	S. G. Guenard,	Bienville, Levis, P.Q.
Sorel,	9	John Matte,	Sorel,	Al. Charbonneau,	P. O. Box 132, Sorel, P.Qa.
Owen Sound,	10	Wallace Robertson,	1030 4th Ave. West,	James Nicoll,	714 4th Ave., Owen Sound, Ont.
Windsor,	11	Alex McDonald,	98 Crawford Ave.	Neil Maitland,	221 London St., W., Windsor, Ont.
Midland,	12	Jos. Silverthorne,	Midland,		
Halifax,	13	Robt. Blair,	29 Preston Street,	Chas. E. Pearce,	Portland St., Dartmouth, N.S.
Sault Ste. Marie,	14	A. E. Lewis,	Box 563, Soo, Ont.,	Geo. S. Biggar,	43 Grosvenor Ave., Sault Ste Marie.
Charlottetown,	15	J. F. McGuigan,	38 Queen Street,	Lem Winchester,	302 Fitzroy St., Charlottetown, P.E.I.
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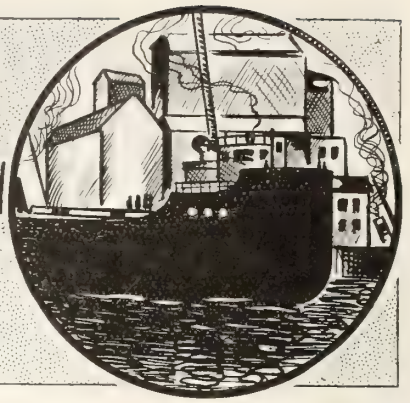

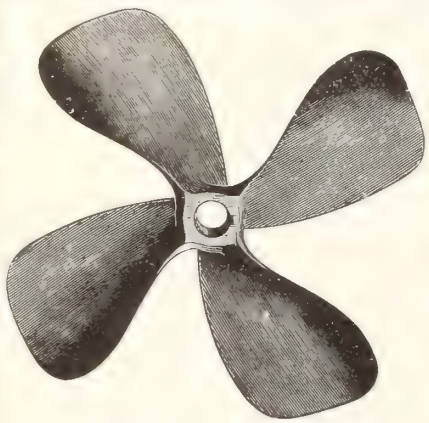

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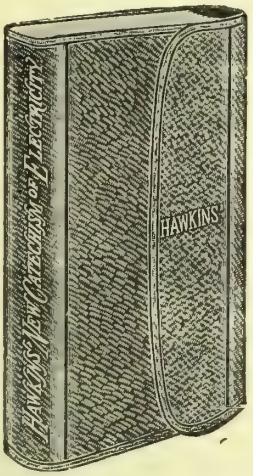

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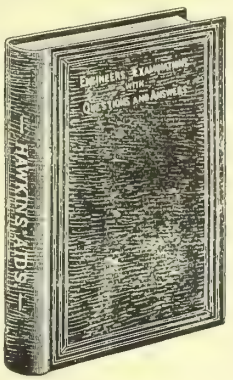

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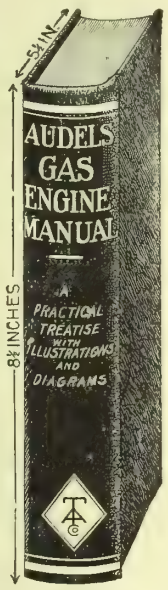

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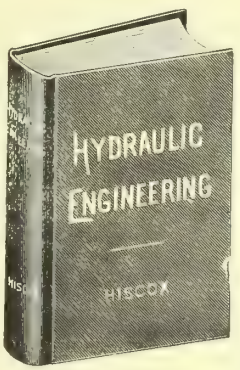

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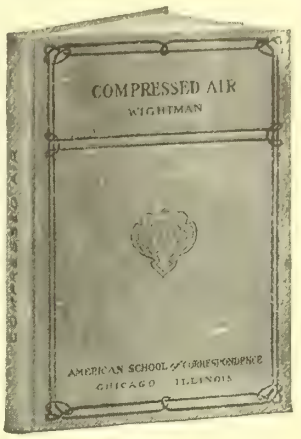

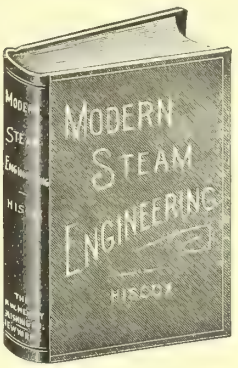

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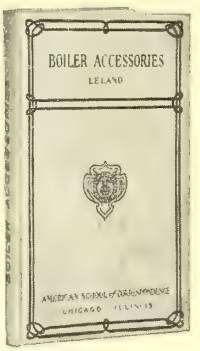

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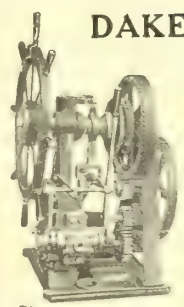

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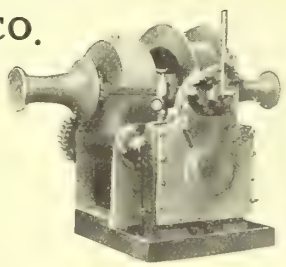

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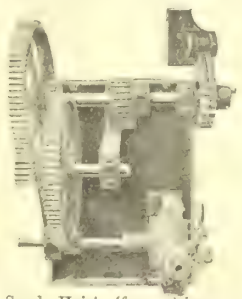

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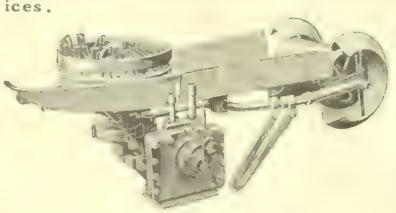

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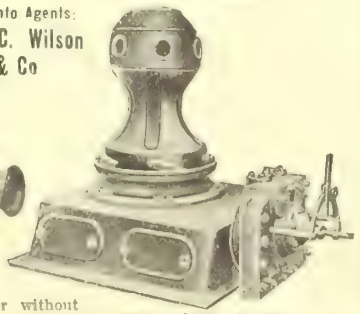

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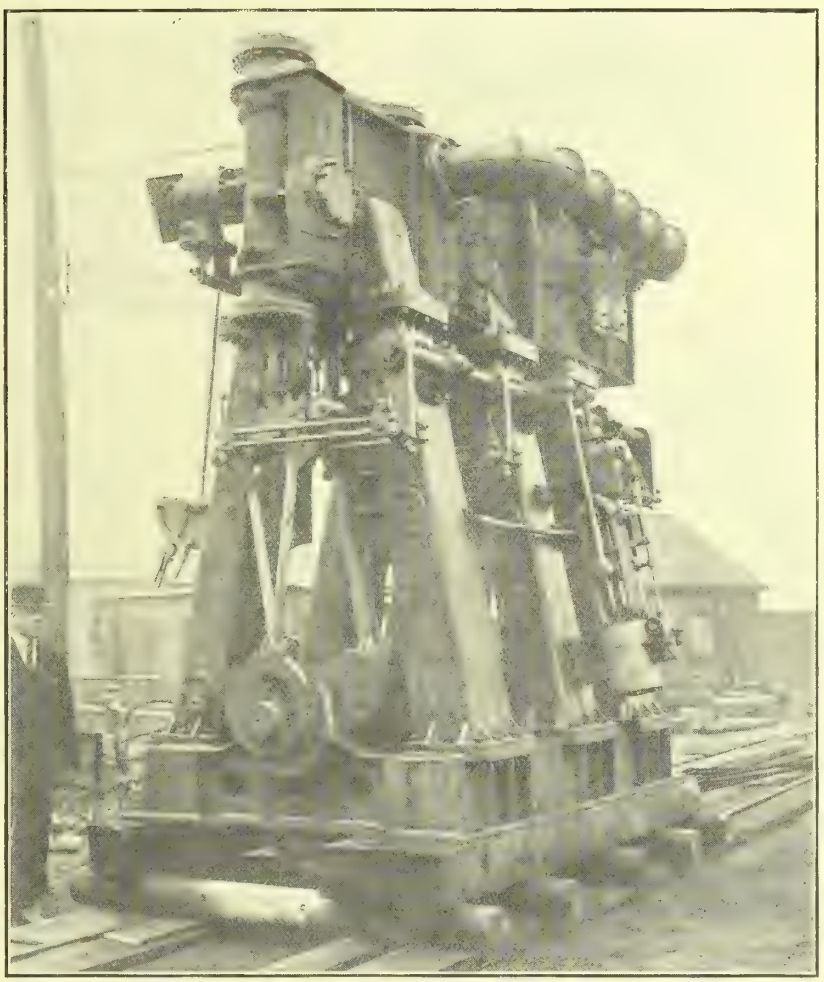

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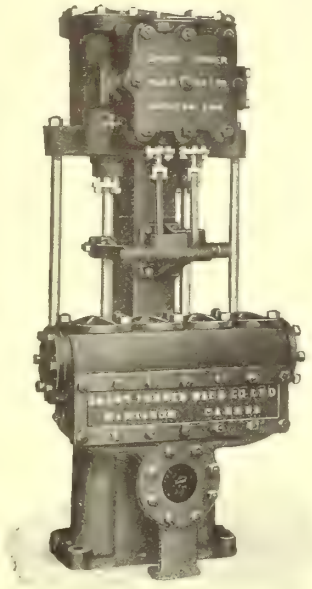

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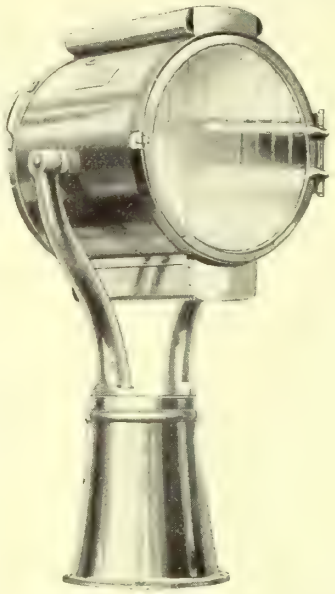

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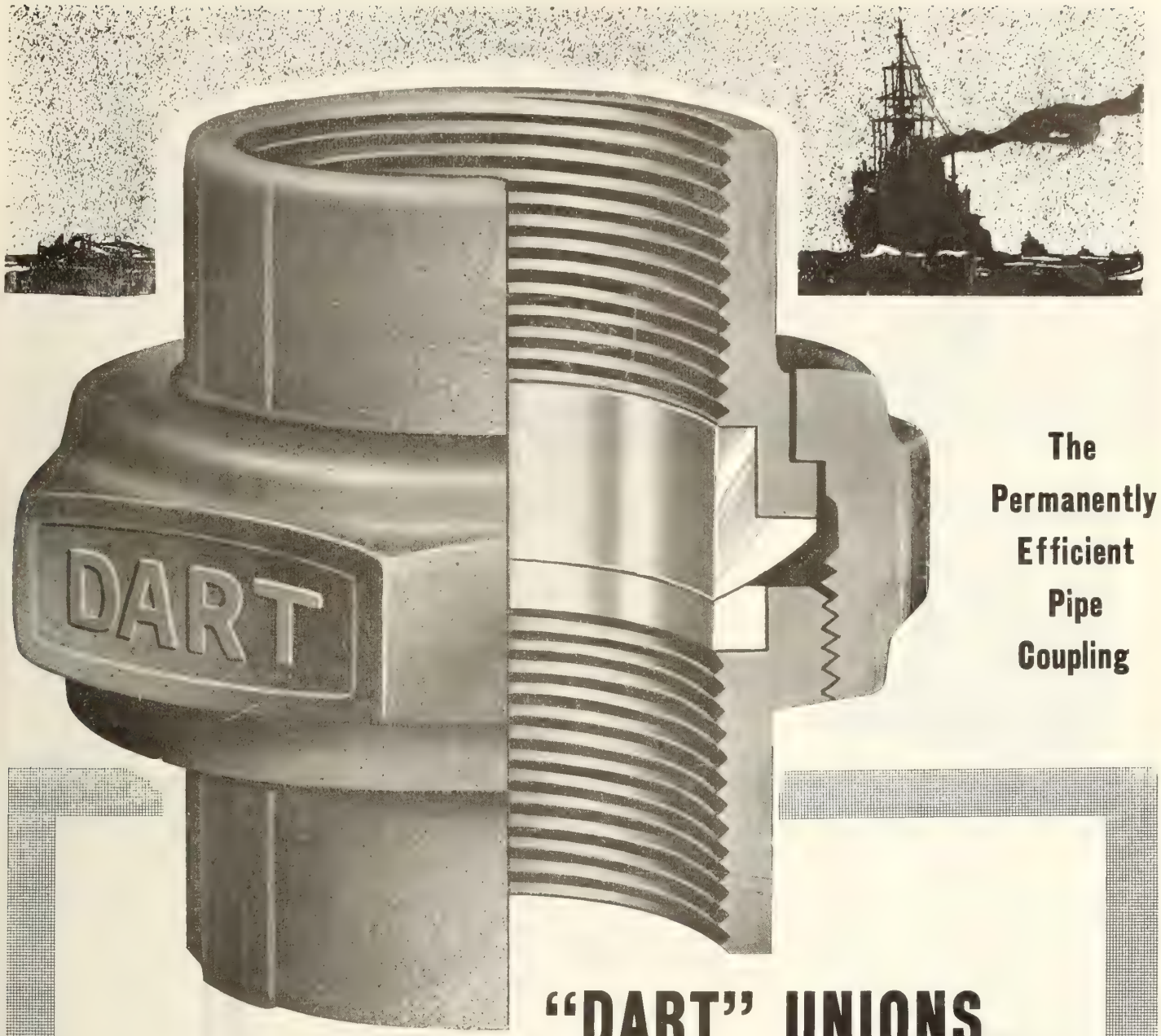

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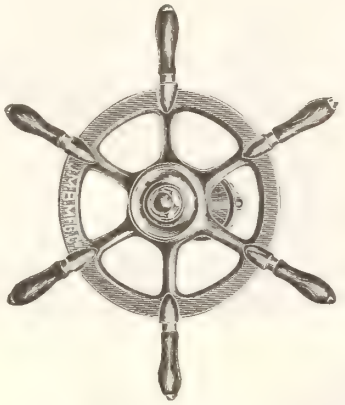

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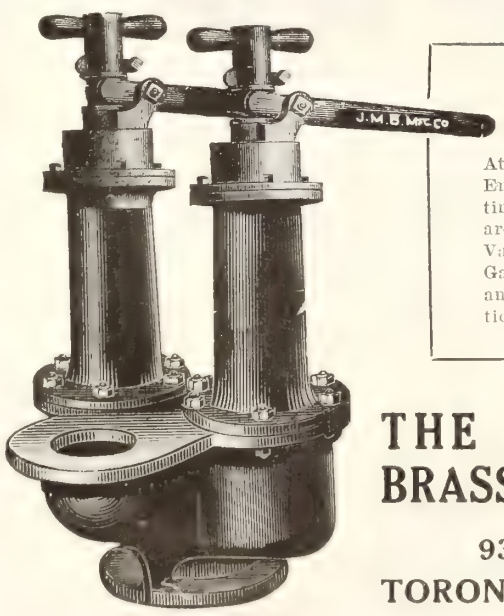

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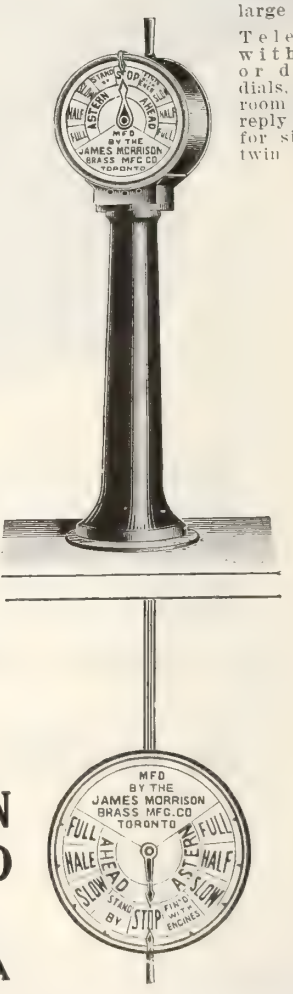

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There is every evidence that the immediate future will see a decided impetus given to shipbuilding and marine engineering on our shores, (lake, river and ocean). The European war has served to accentuate our impotence in the matter. The Vickers' plant is being established on an extensive scale and in the most up-to-date manner and, although some distance from actual completion, its featuring here will be found opportune.

NEVER before in her history has Britain so thoroughly demonstrated that she is a nation of sailors and shipbuilders as in the present crisis. In spite of the fact that the world is perhaps passing through the most momentous times ever, British merchant ships sail the seven seas in comparative safety. No other navy has ever been able to accomplish as much and, entirely due to the above fact, the overseas commerce of the world is today but little interrupted; the German section, of course, excepted. Thus, of all the industries of Britain there is none more closely identified with her very existence than that of shipbuilding. As may be expected, therefore, naval and mercantile marine construction works have been developed to such an extent that no other country in the world can turn out a superior product in these lines.

Vickers, Ltd., in England has established a reputation as one of the foremost of engineering institutions. Their record in various branches of this profession together with shipbuilding, has caused them to be known world-wide. With the establishment of a Canadian plant by them, we have in our midst an industry similar to those that have made Britain a world power. The Canadian firm is known as Canadian Vickers, Ltd., and is a complete and independent unit. The plant is located at Longue Pointe, one of the eastern suburbs of Montreal. Work was started on the site in the summer of 1910, very soon after the Dominion Parliament passed the Dry Dock Subsidy Act, and has been going on continuously ever since, and the plant is now all but complete. The area of the present site amounts to about forty acres. It is near the boundary line of the municipality of Maisonneuve, one of the thriving suburbs of the city of Montreal, and adjoins the easterly limits of the harbor. By referring to the cut in which a general view of the plant is shown, it will be noted that a description of the works can best be eccomplished under the following heads:

Floating dock, fitting-out basin, machine shop, joiners' shop, pump house, iron workers' shed, smiths' shop, plumbers' shop, gas producer plant, shipbuilding berth, central heating system, gate house and general stores, electrical shop, test house, power house, paint shop, boiler shop, engine shop, brass foundry, administration offices, garage, ambulance room, and other minor departments.

The Floating Dock.

One of the most interesting units of the equipment is the floating dock constructed at the works of Vickers Limited at Barrow-in-Furness, England. The dock is built entirely of steel, and was completed and towed to Canada in September, 1912. It is constructed in three sections, which can be locked together as one unit, or each operated separately. When the three sections are operated as a unit, they are capable of docking a ship up to 25.000 tons displacement and in length up to 700 feet.

The registration of the dock shows it to be 17,963 long tons by British Board of Trade measurements. Its actual length is 600 feet, each of the three sections being 200 feet. Throughout the whole length, side walls rise 40 feet above the pontoon deck, the latter being 100 feet wide, with open ends. Underneath the pontoon deck, for the whole width of the dock, are located water-tight compartments. The bottom of the dock is 17 feet below the pontoon deck. One section is employed as a unit when it is necessary to handle very small craft such as tugs, etc., and the other two sections are used as a unit for medium sized craft.

Twelve feet below the top deck of the walls is the machinery deck, where are located the engines, boilers, dynamos, pumps and other equipment necessary to operation. The pumps are of the centrifugal type mounted on vertical shafts direct connected to compound engines with cylinders set on the quarter. When the full battery of pumps is in operation they are capable of emptying all the flooded compartments in 2½ hours, and the largest boat capable of being handled can be docked in that period of time.

To each section of the dock there are two steam-driven pumps, having a capacity of 1,500 gallons per minute. Immediately below the machinery deck there are compartments which are also flooded when it is required to sink the dock for the purpose of taking on a ship. These compartments are used more or less for ballasting purposes, the main water-tight compartments being situated under the pontoon deck. There are forty-eight of these, sixteen being in each of the three sections. Each section is divided into four sections by three longitudinal bulkheads, and there are also three transverse bulkheads extend-

ing the entire width of the dock, thus making the sixteen compartments per section as above stated.

Two 45 kilo-watt steam-driven generators furnish the electricity for lighting, crane and valve operation, all of the forty-eight valves governing the admission of water into the various pontoon compartments being electrically controlled. The lighting system consists entirely of incandescent lights, those illuminating the top walls being placed on special standards. The electric crane is of three tons capacity, and travels along the top of one of the side walls. An important feature is that the general service pumps are fitted so that they can be used for fire purposes if required. The warping of the dock out into the sinking basin and back to the quay again is accomplished largely through the assistance of steam-operated capstans, of which there are eight.

are then flooded until the dock is sunk and the keel blocks are below the level of the keel of the vessel coming aboard. The ship is then guided between the walls of the dock by the above mentioned mechanical shores and centred over the keel blocks. The pumps next proceed to empty the flooded compartments, until the level of the pontoon deck is well above the surface of the water. The dock is then warped to the edge of the basin. When only two sections are used to dock a medium sized vessel, the complete operation can be accomplished in a little over two hours. Compressed air is supplied to the air mains of the dock from a shore compressor plant, and these mains extend along each dock side at two levels, the lower one being on the pontoon deck. The dock was designed by Clark & Stanfield, marine engineers, with offices in London, England.

from the basin, is 1,200 feet in length, and is built on a crib foundation. The ground upon which the main buildings are constructed is largely "made" ground, there being over one and one-half million yards of earth deposited there, after removal from the basin. The number of yards of concrete used in the construction of the retaining walls was 45,000.

Repair Machine Shop.

The machine repair shop is located on the harbour section of the retaining walls of the fitting-out basin and contains a very complete equipment of machine tools. It was about the first to be erected, and all machine repair work is being executed here until the large boiler and general shop is completed. The building is 100 feet long by 50 feet wide, with steel frame and brick walls. Steel trusses support the roof of wooden

"DUKE OF CONNAUGHT" FLOATING DRY DOCK, SHOWING TWO VESSELS ABOARD.

The pontoon deck is equipped with a central line of keel blocks each made up of four 12 in. by 12 in. oak pieces. These blocks are placed along the whole length of the dock, being spaced at intervals of 2 feet 6 inches, centre to centre measurement. When a boat is about to enter the dock she is centred by means of mechanical shores, of which there are four in each wall of each dock section, and with these shores the incoming vessel's keel is placed directly over the keel blocks. On each side of the keel blocks there are found bilge blocks and short oak timbers resting on box beams. These are placed loose on the dock so that they can be arranged to suit each particular vessel. Three levels of working platforms are provided with a difference of elevation of twelve feet.

In operation, the dock is warped out from the wall of the basin into the sinking basin where the depth of water is fifty feet. The pontoon compartments

The Fitting-out Basin.

The immensity of the work involved in constructing the fitting-out basin can hardly be realized unless one actually sees it. The length of the basin is 1,000 feet and the width is 500 feet. The depth at the sides is 30 feet and the depth of the sinking basin in the middle is 50 feet. These depths are reckoned at extreme low water level. The sinking basin, over which a depth of 50 feet exists, is 875 feet long by 150 feet wide at the bottom. It is located in the centre of the fitting-out basin. Retaining walls of concrete form two sides and extend to a height of 28 feet above the level of the water. The width of these walls on top is twelve feet, forming quays upon which are laid standard gauge tracks which connect with all parts of the works and also with the main line spur. These walls were built by the Montreal Harbor Commissioners. The outer or harbor wall, which separates the river

planks, which are covered with tar and gravel. A monitor is located in the centre of the roof and extends for the whole length of the building. Two galleries, one on each side, run the whole length of the shop. The tool store and repair room is on the south side gallery and the foreman's office and drawing-room are on the north gallery. To the east is an extension equal to the whole width of the shop and 90 feet long. Here are located four blacksmith forges, a locomotive type boiler, a duplex boiler feed pump, a plate heating furnace, blast fans, etc. There is also a straight line, 500 cub. ft. auxiliary, steam-driven air compressor, supplied by the Chicago Pneumatic Tool Co. The machines on the ground floor are all set on solid concrete foundations, and most of them are so arranged in groups that they are driven from several line shafts each of which is driven by its own individual 20 h.p. variable speed, D.C. design,

Vickers motor. Some of the larger machines have their own individual motors. A large Niles-Bement-Pond planer is driven by a 30 h.p. Vickers D.C. motor, and a large Bertram vertical drill press by a 5 h.p. Vickers motor. Up to the present, all repairs to marine engines have been carried out in this shop.

In the south gallery there is a metal-cutting band-saw sharpener, built by Noble & Lund, of Newcastle-on-Tyne, and the only machine of its kind in Canada. Other equipment here includes a hand-driven band-saw set, a brazing furnace for making band-saws endless, and a Rice patent high-speed drill, the spindle speed of which varies from 2,066 r.p.m. to 855 r.p.m. It is used for drilling up to ½ inch in diameter.

The Joiners' Shop.

In this shop the patterns for all the iron and steel castings are made; all the wood working is also done here. The shop is 150 feet long by 100 feet wide, and is built in two bays of equal width, a monitor being placed on each bay extending the whole length. The building is two storeys high, and is located on the pier which separates the harbor from the fitting-out basin, being thus on "made" ground. The foundation is of concrete and is placed on 273 concrete piles of the pedestal type. The main floor space is divided into four sections of 25 feet each, the south section being where all patterns are made. The joiners' benches are here, as also the other wood-working appliances.

A rather interesting feature is the color scheme employed in the coloring of the shellac used on the patterns. The gum shellac is cut in alcohol and used in three ways; the first without any coloring, the second colored with red lead, and the third colored with lamp black. The first is used to varnish all core prints, the second for all surfaces that have to be machined, and the third on the remainder of the pattern. In this way, the moulders know at a glance just what will be required of the casting when it is made. The wood-workers also make a practice of painting with glue the ends of the timbers that are used in the construction of the ships. This tends to keep these timbers from checking.

The second and third 25 foot sections contain all the wood-working machinery. The line shafts and their motors are located under the floor and the only moving parts above floor level in connection with the power transmission are the short sections of belt that are led through the floor to the drive pulleys of the machines. All the motors are of the Vickers D.C. variable speed type. A large suction fan in the basement draws through a system of pipes all shavings and refuse from the machines and carries them to the boiler room of the building to be burned.

There is only one machine in the shop with an individual motor drive, that being the Wadkins universal woodworker and pattern-making machine. It is driven by a 5 h.p., Vickers D.C., variable-speed motor. The belting used throughout the shop is of leather, the joints being laced with wire. In the east end of this section is located a tool room which is completely equipped with grinders, etc. An electric glue-melter of one gallon capacity and a six-pot electric glue melter constitute further equipment here. This latter was manufactured by Ransome & Co., of Newark-on-Trent, England.

Following is a list of machines situated in the Joiners' Shop:

Joiners' Shop Tools.

1—24-in. automatic emery wheel tool grinder	J. Sagar & Co., Halifax, England.
1—Moulding cutter grinder	McDowell, Johnstone, Scotland.
1—Plane iron grinder	
1—Mortising and boring machine	T. Robinson & Son, Rochdale, England.
1—Tenoning and scribing machine	Wadkin, Leicester, England.
1—24-in. circular saw	T. Robinson & Son, Rochdale, England.
1—36-in. circular saw (rising and falling spindle)	T. Robinson & Son, Rochdale, England.
1—Dimension saw (any angle up to 45°)	T. Robinson & Son, Rochdale, England.
1—Surface panel planer, facer and edger	J. Sagar & Co., Halifax, England.
1—Universal woodworker and patternmaker	Watkin, Scott & King.
1—Spindle moulding machine (4 bottom irons removable	T. Robinson & Son, Rochdale, England.
1—Band saw	A. Ransome & Co., Newark-on-Trent, England.
1—Planing and moulding machine	A. Ransome & Co., Newark-on-Trent, England.
1—Universal woodworker, boring machine and general joiner	J. A. Fay & Egan, Cincinnati, Ohio.
1—Fret saw and boring machine	T. Robinson & Son, Rochdale, England.
1—Facing lathe for iron or woodworking	T. Robinson & Son, Rochdale, England.
1—12-in. 16-ft. horizontal bed lathe for wood-working	T. Robinson & Son, Rochdale, England.
1—Belt and bobbin sander	J. Sagar & Co., Halifax, England.
Hand power wood trimmers	Oliver Machy. Co., Chicago, U.S.A.

The north section of the first floor is known as the riggers' loft. The machine equipment consists of a patent, portable, compound, hydraulic cable cutter, manufactured by Bullivant & Co. of London, England, after the Selby patent.

On the first floor in the southern portion is located the moulding loft, the level pine floor of which is painted black. All the various curves of the frames, etc., of the ship are developed here and wooden templates made. The north section is fitted out as sail makers' loft, and between the north and south sections is an open space which permits light from the monitors to reach the main floor.

In the basement is located a drying-room where all the lumber for decks and interior work is thoroughly seasoned and dried. The complete stock of lumber and timber is stored here. The motors that drive the machinery on the floor above are also in this basement, and are set on permanent concrete foundations. The building is fully equipped with a sprinkler system of the Esty pattern.

Connected with the joiners' shop at the southwest corner of the building is the boiler room, 47 feet by 17 feet, in which an E. Leonard & Sons, London, Ont., boiler capable of evaporating 5,000 pounds of water per hour is installed. Refuse and shavings can be burned in the Dutch oven combustion chamber with which the boiler is equipped. The boiler furnace is so constructed, however, that at night, when shavings are not available, other fuel can be used. For heating purposes, live steam is delivered into thermo-tanks, through the interior

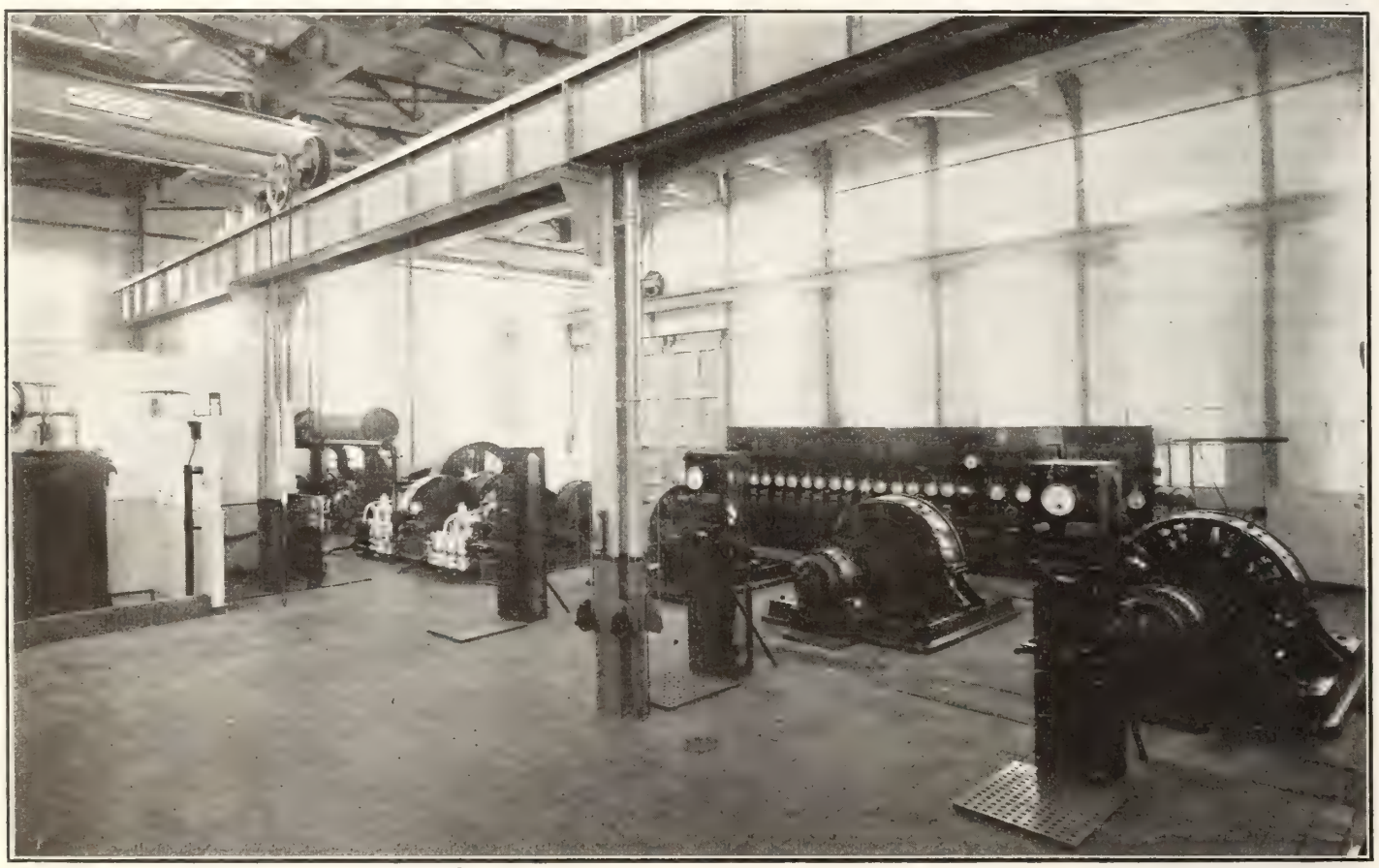
Repair Machine Shop Tools.

1—Planer	Niles-Bement-Pond, New York City.
1—12-in. lathe	Dean-Smith & Grace, Keighley, England.
1—Screw-cutting machine	Thomas Shanks & Co., Johnstone, Scotland.
1—Drill grinder	Canada Machinery Corp., Galt, Ont.
1—Disc grinder	Canada Machinery Corp., Galt, Ont.
1—8½-in. spindle lathe	J. Archdale & Co., Birmingham, England.
1—Patent double tool grinder	Thomas Shanks & Co., Johnston, Scotland.
1—Cold metal band saw	Noble & Lund, Ltd., Newcastle-on-Tyne, Eng.
1—2¼-in. x 24-in. flat turret lathe	Jones & Lamson Mch. Co., Springfield, Vt.
1—Engine lathe	Clark's Mch. Tool Co., Luton, England.
1—Universal horizontal milling machine	Cincinnati Milling Mch. Co., Cincinnati, O.
1—Universal vertical milling machine	Cincinnati Milling Mch. Co., Cincinnati, O.
1—Horizontal boring and facing machine	G. & A. Harvey, Glasgow, Scotland.
1—24-in. stroke double head shaper	J. Archdale & Co., Birmingham, England.
1—4-ft. radial drill press	Wm. Asquith Co., Halifax, England.
1—Horizontal drill press	J. Archdale & Co., Birmingham, England.
1—Vertical boring machine	Niles-Bement-Pond, New York City.
1—Vertical drill press	J. Bertram & Sons, Dundas, Ont.
1—Capstan lathe for brass work	
1—Radial drill press	J. Archdale & Co., Birmingham, England.
1—Screw-cutting lathe, ⅜-in. to 1½-in.	Barrows Patent.
1—12-in. slotting machine	Niles-Bement-Pond, New York City.
1—Gear planer (up to 8 inches)	Gleason Machine Works, Rochester, N.Y.
1—Pipe flange drilling machine	J. Archdale & Co., Birmingham, England.
1—Horizontal boring, milling and tapping machine	

coils of which air is passed and heated; the heated air being then delivered through the building by means of a system of pipes. The circulation is obtained by a motor-driven fan.

Iron Workers' Shed.

The ironworkers' shed contains more interesting features than, perhaps, any other unit of the works. It is, at the same time, the largest building, and consists of one storey laid out in three bays. Two of these bays are 500 feet long and 50 feet wide, while the third is 300 feet long and 50 feet wide. The frame and roof trusses are of steel, and monitors over each bay extend the whole length. The walls are of brick while the foundations are entirely of concrete built on concrete piles. The machine tool equipment in this building is one of the most complete in Canada.



INTERIOR OF POWER HOUSE, CANADIAN VICKERS' PLANT.

Machines in Ironworkers' Shed.

Multiple punch, automatic screw feed, travel 30 ft., length of machine 60 ft., capacity 25 holes in plate up to one inch thick at each operation, driven by 30 h.p. Vickers motor.

Two radial drills, pillar type, Asquith pattern, served by 5-ton electric crane.

1-in. x 8-ft. combined bending and straightening rolls.

21-ft. plate bending rolls.

1-inch punch and shear (combination), punch capacity, 1½-in. hole in 7-in. plate; shear capacity, 1-in. plate; manhole punch will cut in one stroke an opening 23 in. x 16 in. in plates 1 in. thick; equipped with two 10-ton jib cranes mounted on the frame work.

1½-in. punch, shear and notcher, motor driven, will cut notch or square hole 4 in. x 4½ in.; served by jib cranes attached to frame.

1¼-in. punch and shear (2 punches) motor driven, served by jib cranes attached to frame.

Two radial countersinking machines, Bertram pattern, vertical spindle attached to wall, 200 r.p.m., belt-driven.

36-ft. planer for nickel steel plates up to 2 in. in thickness. The plates are held in place on the machine table by twelve hydraulic jacks on top of frame, or by twelve screw jacks. The carriage carrying the knives is driven by 20 h.p., D.C. Vickers motor.

36-ft. bending rolls with total weight of 240 long tons. Two motors, each 40 h.p., D.C. Vickers type, on top frame, move the rolls. The bottom rolls are 16 inches in diameter and the top roll 20 inches. The speed of elevating screw on fast gear is 4.55 inches per minute, and the slow gear, 0.83 inches per minute. With this machine, nickel steel up to 2-in. in thickness can be handled. Rolls are driven by a 200 h.p., D.C. Vickers motor.

Doxford roller press, with 35 h.p., D.C. Vickers motor.

Hydraulic keel plate bender, for cold plates up to 1¼ in. thick, made by Hugh Smith & Co., Glasgow.

Lambie hydraulic joggler, 60 tons pressure, single cylinder.

Combination motor-driven horizontal punch, double angle cutter and beam bender, capacity 6 in x 6 in. x 1 in. angles in centre, shape bender and straightener in other end; makers, Craig & Donald, Paisley, Scotland.

Swivel cutter for cutting all kinds of shapes, mounted on turn-table, hydraulically operated, the only one of its kind in Canada.

1-in. punch and shear, motor driven.

Fan for supplying blast to beam smiths' fires.

Circular cutter, cold friction saw.

Three 10-cwt. pneumatic hammers, by Pilkington Co.

One 5-cwt. hammer. One 2-ton single cylinder hammer.

Hydraulic pipe bender of 60 tons pressure; Sir Wm. Arrol & Co., makers.

Panel shear.

Disc grinder, double belt driven; Burton Griffiths, makers.

Hydraulic flanger, 60 tons, capable of flanging mild steel plates 4 feet. long by ¼ in. thick.

Band-saw, motor driven, for metal cutting; Noble & Lund make.

250-ton hydraulic press for boiler plates, by Hugh Smith & Co.

Circular cutter.

Punch and shear, motor driven.

2-in. pipe threader, belt driven.

4-ft. bending rolls.

4-in. pipe threader, belt driven.

6-in. pipe threader, belt driven.

5-ft. bending rolls, motor driven.

Radial drill, pillar type, driven by 10 h.p., D.C. Vickers motor.

8-ft. bending rolls, motor driven.

Bevelling machine, motor driven; Davis & Primrose, makers, Edinborough.

All the machines are placed on concrete foundations of a permanent nature, which in the case of some of the larger units, consist of the addition of concrete piles.

In the centre of the shop are located a bar furnace and a plate furnace equipped with a special stack and blowers. Immediately in front of these furnaces are large bending slabs of cast iron. These are placed on concrete foundations and so constructed that passages are provided underneath the slabs through which scale can be removed. To the south of the furnaces are the scrieve boards of pine planks 6 in. by 2 in. These scrieve boards are 120 ft. long by 50 feet wide. The planks are laid on heavy stringers embedded in the earth.

At the west end of the shed, tools and equipment for smiths, plumbers, coppersmiths and tinsmiths are installed. These embrace a number of forges all connected with blast and suction pipes.

IRONWORKERS' SHED FROM WEST END.

The suction equipment consisting of hoods placed over each forge. There are 6 angle smiths' forges, 11 smiths' forges, and 6 coppersmiths' forges. The forges are all of English Sturtevant type. The blast fan is a No. 8 American Sturtevant, driven by a 36 h.p. Vickers D.C. motor, direct connected and running at 1,660 r.p.m. There are two sets of air blast units, one being held as a standby only. Two 4-ft. by 4-ft. double pattern Mecol forges with hoods, supplied by the Mechanical Engineering Co. of Montreal, P.Q., are also located here.

The plumbers' and smiths' shops are fully equipped with modern tools. Near the south wall, opposite the 2-ton hammer, is a large gas-fired reversing regenerative forge furnace of Dowson & Mason make. This hammer and furnace are served by an electric jib crane of 7½ tons capacity. South of the iron workers' shed are located the gas producer plant and annealing furnace. At the west end of the building are stores and foremen's offices. The steel stock yards are to the west and north of the building. All parts are reached by industrial tracks. To the south are located platers' boards roofed over and iron workers' tool store, foremen's offices, and air compressor house.

In the compressor house there is a two-stage Canadian Ingersoll-Rand machine with a capacity of 2,200 cubic feet per minute at 100 lbs. pressure. It is driven by a 3-phase, 350 b.h.p., 60 cycles, 2,200 volts, 140 r.p.m., Vickers motor. The crane equipment in the iron workers' shed includes three 7½ ton, 30 ft. radius; two 7½ ton, 25 ft. radius; two 5-ton, 25 ft. radius; and one 5-ton, 20 ft. radius. These are all electrically operated, and of the jib type. A large number of hand-power jib cranes equipped with chain blocks are also installed, the whole being served by a complete system of narrow gauge railway tracks.

GATEHOUSE, STORES AND AMBULANCE ROOM, WITH POWER HOUSE AND ELECTRICAL SHOP TO LEFT.

Gas Producer Plant.

This plant is of the Duff pattern in two units, burning bituminous slack coal. The unit rate of gasification per hour is 7½ cwt., and the volume of gas is 130,000 to 135,000 cubic feet per gross ton of coal. The amount of steam used runs about .5 to .6 lbs. per pound of coal consumed, giving an efficiency per unit of from seventy-five to eighty per cent. The manufacturers guaranteed an efficiency of 75 per cent., also that the ashes would not contain more than 40 per cent. of carbon. There is an auxiliary steam apparatus which consists of a 20 h.p. water tube vertical boiler.

In operation, the coal is fed by hand into hoppers from the charging platform. A steel stack, 60 feet high, is built for this unit, the inside diameter of which is 3 feet 9 inches. The stack is lined with fire-brick, and is self-supporting. The entire equipment was supplied by the Dowson & Mason Gas Plant Co., Birmingham, England, and the gas is burned in the various furnaces throughout the ironworkers' shed.

Shipbuilding Berth.

The shipbuilding berth adjoins the ironworkers' shed, and is situated to the north of it. The length over all is 500 feet and, clear width between columns, 116 feet. The over-all width is 132 feet. The floor is a natural earth floor, with a rather pronounced slope away from the water. The height of the shed at the water end is 100 feet and, at the shore end, 80 feet. Thus the grade of the floor is 9-15 of an inch per foot.

The frame is entirely of steel, as are the roof trusses. The foundation is of concrete, while the walls proper, to within 25 feet of the eaves, are of rough glass in sheets 72 in. x 18¼ in. in steel

frames. For a depth of 25 feet all around the building below the eaves the walls are of corrugated galvanized sheeting. Three hundred and fifty-two concrete piles are driven under the column footings and the side walls.

A rather interesting feature of this building is a movable or "flitch" dam, which has been constructed across the entire lower end of the berth. The top of this dam is level with the top of the basin walls, and its construction was with the idea in mind that freshets in the spring, or ice jams and blockades, would cause the water to back up and interrupt work. With the aforementioned arrangement, work on vessels can be carried on continuously during all seasons of the year. The water end of the shed is open in the warmer months, and in winter a temporary wall of wooden panels is placed there to protect the workmen and keep the snow and weather out. The "flitch" dam rests on a concrete foundation, 29 feet wide and 8 feet deep, and this foundation rests on 130 concrete piles.

In order that scouring may be prevented, a single row of steel piles, 25 feet long, have been driven across the entire width of the berth, and 12 in. back from the face of the mat foundation. These piles are of the interlocking Carnegie type, and their tops have been imbedded in the concrete. The steel frame of the dam is composed of standards braced at intervals with steel struts, which are anchored in the concrete mat, as also are the standards. Between the standards, 12 in. x 12 in. stop logs are placed. An I-beam trolley is fitted to the crane girders, and is operated by a hand-power winch; by means of this the stop logs and portable panels are handled.

Two timber slip-ways parallel each other at 53 feet centres, and extend beyond the berth for a distance of 120 feet. Inside the building for the full length and extending across the entire width of the shed are laid 12 in. x 12 in. timbers, and on these cross timbers there are laid longitudinal timbers which will carry the keel bilge blocks and launch-ways.

The shipbuilding berth is well supplied with cranes, the equipment consisting of four cranes of 5 tons capacity each, with a span of 22 feet 4 inches located on each side. A fifth crane of 5 tons capacity with a span of 60 feet is located in the centre. The sixth crane is of 35 tons capacity, and is also located in the centre. The arrangement is such that the 35 ton crane can serve the centre of either of two ships under construction side by side. All crane girders are suspended from the roof trusses, and the operation of the cranes is through the medium of electricity. The cranes were manufactured by Sir William Arrol & Co., Glasgow. Further equipment consists of two electric winches, which are installed on the slip-ways.

Power House Building.

This building is in reality a triple unit, embracing the power house, electrical shop, and test house. The total length of the structure is 160 feet and the width 66 feet. The construction features are as follows:—Steel frame, concrete foundations, steel roof trusses and brick walls. The foundation is built on 252 concrete piles, and monitors are placed on the roof extending for the whole length of the building.

The power house section is 80 feet long, and extends for the whole width of the building. The floors are of tile. Current is obtained from the Montreal Light, Heat & Power Co., and is received at 11,000 volts, being afterwards stepped down to 2,200 volts, at which it is supplied to the induction motors which drive the air compressors, hydraulic pumps, and fire service pumps. Current is stepped down to 315 volts for the three sets of Vickers self-synchronising rotary converters. Each of these converters is of 750 kilowatt capacity, revolving at a speed of 720 revolutions per minute.

There are six Vickers induction motors, two being of 350 h.p. each, and connected to the air compressors. Two others of the motors are 90 h.p. each, and drive the hydraulic pumps which supply water pressure to the hydraulic machinery. The remaining motors are of 250 h.p. each, and drive the fire service pumps.

All of the 200 motors of Vickers D.C. variable speed type situated throughout the works are supplied with current from a three-wire circuit at 440 volts and 220 volts. This current is taken from the rotary converters. The general lighting current is 220 volts. The compressor located in this room is a two-stage Ingersoll-Rand unit, with a capacity of 2,200 cubic feet of air per minute at 100 lbs. pressure. A similar unit is placed in the ironworkers' shed. Both compressors are joined up to one large air main, which serves the whole plant. The transformers were supplied by the Canadian Westinghouse Co., and the switch-board equipment by the British firm of Ferranti, Ltd. Further equipment in this building are two hand-operated traveling cranes of 10 tons capacity and 37 feet span, supplied by the Herbert Morris Co., Toronto.

The hydraulic force pumps, accumulator and storage tanks are all located in the power house. The force pumps are of the horizontal triple ram type, operating in parallel. These pumps are automatically started and stopped by means of solenoid switches, so arranged that the driving motors can be run at full speed before loading. The pumps are automatically unloaded before stopping. Two motor-driven centrifugal pumps connected in parallel lift the water from the river and raise it to the storage tank. The lift is about 90 feet. The water flows by gravity from the storage tanks to the pumps and the pumps force it into the accumulator. The ballast on the ram consists of 179 tons of slag and sand. This maintains a pressure of 1,500 lbs. per square inch in the hydraulic mains. The mains extend to all the buildings throughout the plant where the pressure is required, and are of seamless steel piping, with cast steel oval flanges. This equipment was supplied by Stewart & Llyods, of Glasgow, Scotland. The remainder of the hydraulic equipment was manufactured by the Leeds Engineering Co., Leeds, England.

Electrical Shop and Test House.

Here, the machines are all belt-driven from a line shaft connected to a 10 h.p., d.c. Vickers motor. In the electrical shop is installed a long work bench equipped with twelve semi-steel, solid bar, Parker vises. There is also an impregnating plant for treating field coils. A wire and cable storage room is provided, and a 3-ton hand operated crane with a span of 32 feet travels over the whole floor area, the floor consisting of creosoted blocks on a concrete base. The following equipment is found in the electrical shop:—

Electrical Shop Equipment.

1—Double disc grinder.
1—Sheet shears and rolls.
1—Wet stone.
1—Shaper.
1—Radial drill.
2—Screw-cutting lathes.
1—Engine lathe.
1—Coil taping machine.
1—Coil winding machine.
1—Band saw.
1—Hand portable punch.

The shop is protected by an "Esty" system of sprinklers.

The test house is equipped with a horizontal testing machine, having a capacity of 100 tons, used for tension, compression and bending tests. The machine was manufactured by Joshua Buckton & Co., Leeds, England.

Engine and Boiler Shops.

These shops are all located in one building, the length of which is 380 feet and the width 155 feet. The height from the floor to the roof trusses is 28 feet. The building is of steel frame construction, with concrete foundations on concrete piles, and brick walls. The building is divided longitudinally into three bays of widths: 65 feet, 51 feet, and 39 feet respectively. Above the narrow bay is a gallery 310 feet long, and on the

latter is located a turbine blade workshop, blading template floor, blade assembly benches, lockers for blades, etc.

The west half of the building will be used as a boiler shop, and is divided into three sections—for boiler work, machine work, and erecting. The engine shop will occupy the east half of the building. Two lines of standard gauge tracks run through the shops. In the engine and boiler shop are three 25-ton and one 5-ton traveling cranes electrically operated. These were designed and manufactured by Sir Wm. Arrol & Co., Glasgow, Scotland. The following is a list of the machine tool equipment:—

Engine and Boiler Shop Equipment.

Duplex radial drill; six spindle multiple drill.

Horizontal drilling machine; 5-in. spindle.

Horizontal drilling machine, 3-in. spindle.

Duplex radial drills; vertical drill.

5-ft. 6-in. radial drill; 72-in. turbine lathe.

36-in. duplex lathe, double header.

8-ft. chuck lathe; 14¼-in. gap lathe.

12-in. gap lathe; 36-in. circular planer.

Two No. 3 facing and boring machines.

Turret lathe; capstan lathe; profile milling machine.

Universal milling machine; vertical milling machine.

24-in. double head shaper; 12-in. slotting machine.

24-in. slotting machine; wormwheel generator.

Bevel gear planer; screwing machine.

No. 2 turbine blade tipping machine.

Turbine blade drilling machine.

Turbine blade rumbling machine.

Section washing tank; 20-in. disc grinders.

Sensitive drill; flanging press and furnace.

The largest machine in the engine shop is a 36-in. double duplex patent lathe with 4 carriages, 2 headstocks, and 2 tailstocks, each pair being driven by a 52 h.p., d.c. motor 320 to 960 r.p.m. Vickers type. It is used for machining marine engine shafts, etc. The length of bed is 113 ft. and that of the foundation 120 ft.

Brass Foundry.

The brass foundry is located in the northeast corner of the engine shop. It is of one storey and 60 ft. x 40 ft. In the foundry are to be found six pot fires, emery wheel, drying stove, sand shed, metal shed and coke storage. The brass parts required for the engines will be made here. Provision has been made to secure the very best results in the matter of metal mixtures and, special attention has been given to cored work and the production of absolutely clean castings.

IRONWORKERS' SHED FROM EAST END, CANADIAN VICKERS PLANT.

Elliptical hole boring machine; plate edge planing machine.

Thermotank, fans and motors.

24-in. double head shaping machine.

Pipe drilling and facing machine; "Johns" splitting shears.

Horizontal plate bending rolls; vertical hydraulic plate bending machine.

One fixed hydraulic riveting machine; tube cutting machine.

Circular saw; tool grinders.

Screw-cutting machine, levelling block.

Smiths' hearth; testing machine.

Hydraulic intensifier, electro-depositing bath; motor and generator.

Acid pickling bath; soda washing bath.

72-in. x 72-in. x 14-ft. planing machine.

Compound planing machine; turbine boring machine.

Band saw; portable milling machine.

Saw sharpening machine; saw setting machine.

Keyway cutting machine; 28-in. disc grinder.

Tool grinder; sensitive drill.

No. 2 facing and boring machine.

8½-in. brass finishers' lathe.

6½-in. capstan lathe; 12-in. gap lathe; 9-in. capstan lathe.

5-ft. radial drill; horizontal drilling machine.

Semi-automatic duplex milling machine.

24-in. shaping machine; 8-in. slotting machine.

Tool grinder; turbine blade press; screw press.

Turbine blade sawing machine; turbine blade knicking machine.

No. 1 turbine blade tipping machine.

Water Supply.

Cast iron water pipes have been extended to all parts of the plant, and 22 fire hydrants of the Ludlow non-freezing slide gate type have been installed. Connections have been made with the city mains on Notre Dame Street and with the city mains on the river bank, and a pumping station is located west of the joiners' shop on the south side of the fitting-out basin. A pressure of 100

pounds per sq. in. is maintained throughout the system.

Two motor-driven pumps capable of delivering 1,500 Imperial gallons per minute against a head of 350 feet are installed. They are driven by two Vickers d.c. motors, each of 250 h.p. The pumps were manufactured by the Pulsometer Engineering Works, London, England.

Central Heating Station.

This department consists of a one-storey building, 136 feet long by 50 feet wide, of steel frame work, on a concrete foundation supported by concrete piles. The walls are of brick. The station units comprise boilers, steam test house, economizer, conveyors and stack.

The boilers are Babcock and Wilcox water tube make, and are designed for a working pressure of 200 lbs. Each boiler has a heating surface of 3,720 sq. ft. The units now installed deliver 2,500 boiler horse power, but eventually 4,000 boiler horse power will be available. The steam is used for heating purposes in connection with the thermo tanks. One of the boilers now installed has a working pressure of 320 lbs., the steam from which is used for testing purposes. Green economizers with chain grate stokers and coal breaker equipment are installed on all the boilers, and were supplied by Babcock & Wilcox. An ash handling plant, as well as coal conveyors with a capacity of 40 tons an hour, were also furnished by them. The boilers are operated under natural draft, and the five units now installed when burning 20 lbs. of slack coal per hour per square foot of grate area will evaporate 64,000 pounds of water.

Integral steam superheaters, each having 572 sq. ft. of heating surface are installed in each unit. These impart 150 degrees Fahrenheit of superheat to the steam. This equipment is Babcock & Wilcox standard. The automatic chain grate stokers are capable of burning coal containing 30 per cent. of hydro-carbon and approximately 13,000 B.T.U. per pound of dry coal, smokelessly. All the valves and headers on the boilers are of cast steel. The height of the stack is 175 feet.

System of Heating.

All the buildings are heated by thermo-tanks. The air is taken from the atmosphere and passed through the tanks which contain steam coils of cast iron. Circulation is maintained by a motor-driven, direct connected, blast fan running at 800 to 1,100 r.p.m. The heated air is then distributed through sheet metal pipes. A very elaborate system of registers and controls have been devised. Steam is carried to the tanks from the boilers through mains in a tunnel to all buildings except the joiners' shop.

The Tunnel.

The tunnel is about 3,000 feet long, and extends from the engine and boiler shop to the iron workers' shed, and around the fitting-out basin on the south side to the floating dock. It connects all the buildings. The inside dimensions are 6 ft. by 6 ft. The bottom and top are of concrete, the top being heavily reinforced.

For the whole length of the tunnel on 10-ft. centres, heavy concrete girders, resting on concrete piles, have been constructed in the floor slab. The tunnel is constructed entirely below the frost line, and manholes are spaced at various intervals. The use of the tunnel is for conveying water, steam and air mains, also electric cables. The following mains pass through it: A 12-in. fire service main; a 2½-in. hydraulic high-pressure main; a 5-in. steam main with a 4-in. return; an 8-in. compressor air main; a 4-in. drinking water main, and a 10-in. steam main at 200 pounds pressure for testing turbines in engine shop. The electric cables in the tunnel are all supported on porcelain insulators.

Lighting System.

Various types of lighting are used in the different shops. The lighting of the floating dock is by incandescent lamps. The shipbuilding berth, iron workers' shed, engine and boiler shop, and other of the larger buildings where it is necessary to do accurate work, are lighted by mercury vapor lamps of the Westinghouse-Cooper-Hewitt type. These lights are each of 3,500 c.p. In the joiners' shop and the yard the illumination is obtained from 150 arc lights of the Monarch type. These lights are of 600 c.p. each, manufactured by Verity's, Ltd., Birmingham, England. All the systems are of the direct current type. The lighting in the administration building and general stores building are of the incandescent type on A.C. circuits.

Pneumatic Equipment and Tools.

There are two compressors manufactured by the Canadian Ingersoll-Rand Co. One of these is located in the compressor house and the other in the power house. These compressors are both connected to a common main of 8 in. diameter, which entirely encircles the works, and branch connections extend to each shop and department. To give an idea of the complete system, it may be stated that there are 240 connections on the floating dock and 300 in the shipbuilding berth. The pneumatic and electric tools used throughout the works were manufactured by the Chicago Pneumatic Tool Co.

New Boyer riveting hammers Nos. 60, 80 and 90 are being used in conjunction with Boyer standard short holders-on and Boyer combination holders-on for driving rivets in boilers and other work of this character. Special short No. 50 Boyer riveting hammers with inverted handle are used for riveting in the bows of ships where space is limited. New Boyer and New Chicago chipping hammers are being used for chipping along the edges of plates when required, also for caulking and general work. The "F" Boyer hammer is used for chipping paint and scaling off the sides of ships which are to be repaired. Little Giant pneumatic drills are being used for all metal boring, including reaming of holes, and Little Giant wood boring machines are used for boring holes for timbers for the dock. A No. 2 Boyer rivet buster is used for breaking the heads of rivets condemned by the inspectors. Duntley electric drills are used in all parts of the plant where air is not available. The sizes used are from the Midget drill to No. 3. Protection Brand hose with woven steel armor for water, steam and air is in use throughout the works. There is also found a special large air hose with cotton jacket of Protection Brand which is used for carrying compressed air from the air mains to the floating dock. All hose was manufactured by the Woven Steel Hose & Rubber Co. of Trenton, N.J. The pneumatic and electric tools above described were supplied by the Holden Co., Montreal.

General Stores, Gate House and Ambulance Room.

These departments are all housed in one building 103 feet long by 34 feet wide. The building is of two storeys and a basement. The constructional features are as follows: Steel frame, brick walls, concrete foundation, on 88 concrete piles. The floors are of reinforced concrete designed to carry 400 lbs. per square foot. Messrs. Dartnell, Limited, received the contract for the waterproofing of this building. Waterproofing compound manufactured by the R. T. W. Damp Resisting Paint Co. was mixed with the concrete in the side walls and lower floors. Furthermore, a 1-in. surface coat of cement mortar mixed with the compound covers all the exposed parts of the concrete. The lower floors are dust-proofed with Toch Bros.' filler. The whole building is of fireproof construction.

Installed in the building is an Otis-Fensom elevator used for freight service. The elevator shaft is constructed of wired glass and is fireproof. As its name would signify, the building is located at the main entrance of the works. The gate office is located here, also the general stores. An ambulance and a first aid equipment is located in the building; thus the welfare of the workmen is well attended to.

Administration Offices.

These are located at the north-east corner of the property of the company, and front on Notre Dame Street. They are of three storeys and basement. The length is 120 feet and the width 54 feet. The building is of fireproof construction and is reared on concrete foundations. The walls are of brick. The structure being on natural ground, no piles were required. The framework is of steel.

The building is divided into two sections. The construction of the windows is the ordinary type. In the eastern section there are found the stairways, vaults, and the offices of the chief draughtsman. In the centre section, the main and the draughting offices are located. The western section contains the offices of the executives, board room, dining rooms and kitchen. The kitchen is located on the top floor.

On the roof is found the sun printing, photograph and electric printing rooms. The interior trim of the offices is of oak and mahogany. Heating in winter and the cooling in summer is accomplished by the Carrier Air Conditioning System, in connection with which is an air washing plant. The stairways in the building are of ornamental iron manufacture, and were installed by the Dominion Architectural Iron Works, Ltd., The stair-heads are of concrete, finished with Toch Bros.' dust-proof cement floor paint.

PHILIP LESLIE MILLER,
Naval Architect and General Manager, Can. Vickers, Ltd., Montreal.

ADMINISTRATION OFFICES, FACING NOTRE DAME STREET.

General Construction.

Sir William Arrol & Co. were responsible for the design of the buildings, and T. Pringle & Son, Montreal, designed the administrative offices, gate house and central heating station to the requirements of the Canadian Vickers, Limited. The general contractors for the construction of the plant were the E. G. M. Cape Co., Montreal. The sub-contractors were as follows:—MacArthur Concrete Pile & Foundation Co., New York, concrete piling; Keystone Fireproofing Co., New York, fireproofing; Alphonse Custodis Chimney & Construction Co., New York, brick chimney; Robert Reid, Montreal, floor and tile work, granite; Hadrian Flooring Co., Montreal, floor and tile work; Douglas Bros., Ltd., Montreal, kalamein work; Wm. Rutherford & Sons Co., Montreal, millwork; F. Tremblay & Co., Montreal, millwork; U. Pauze & Fils Co., Montreal, millwork; Dominion Architectural Iron Works, Ltd., Montreal, ornamental iron work; Canada Creosoting Co., Toronto, paving blocks for floors; P. J. Sullivan & Co., Montreal, plumbing and heating; Thomas O'Connell, Montreal, plumbing and heating; Trussed Concrete Co., Montreal, reinforced steel; Dominion Bridge Co., Montreal, steel work; Phoenix Bridge & Iron Works, Ltd., Montreal, steel work; Steel & Radiation, Ltd., Montreal, steel sash; G. W. Reed & Co., Montreal, waterproofing; Dartnell Ltd., Montreal, waterproofing; Francis Hankin & Co., Montreal, waterproofing; Geo. W. Reed & Co., Montreal, roofing; Richardson & Simard, Montreal, roofing; Metal Shingle & Siding Co., Montreal, roofing; Canadian H. W. John-Manville Co., Montreal, roofing; Sibley & Huot, Montreal, roofing; Master Builders Co., Montreal, flooring; Pedlar People, Ltd., Montreal (Oshawa), reinforcing, Clinton wire cloth; Sherwin-Williams Co., Montreal, paint; LaPrairie Brick Co., Montreal, brick; Canada Cement Co., Montreal, cement.

Plant and Equipment.

Ahern Safe Company, Montreal, safes; Sir Wm. Arrol & Co., Glasgow, heavy cranes, hydraulic presses, etc.; Babcock & Wilcox, Montreal, boilers and auxiliary equipment; John Bertram & Sons, Dundas, radial drills; British Westinghouse Co., London, England, Cooper-Hewitt mercury vapor lamps; Brown Hoisting Machinery Co., Cleveland, locomotive cranes; Canadian Fairbanks Co., Mont-

real, "Byers" pipe; Canadian Ingersoll-Rand Co., Montreal, compressors; Carrier Air Conditioning Co., New York, office ventilation and heating; Chicago Pneumatic Tool Company, Chicago, pneumatic and electric tools; Dowson & Mason Gas Plant Co., gas producers and furnaces; Ferranti Electrical Co., Toronto, panels; Holden Co., Montreal, pneumatic tools and armoured hose; Leeds Engineering Co., Leeds, Eng., hydraulic accumulator and ram; Ludlow Mfg. Co., Troy, N.Y., fire hydrants; MacArthur Concrete Pipe and Foundation Co., concrete piling; D. K. McLaren, belting; Ed. Morris Crane & Hoist Co., chain block and travelling cranes; Office Equipment Co. of Canada, Montreal, furniture and office equipment; Otis-Fensom Elevator Co., Montreal, freight elevators; C. Parker Co., Meriden, Ct., patent vises in electrical shop; Paterson Mfg. Co., Toronto, roofing materials; P. Pilkington & Co., England, pneumatic hammers; Pulsometer Engineering Co., Reading, England, pumps; Hugh Smith & Sons Co., Glasgow, bending rolls, etc.; Springer Lock Co., Belleville, monitor sash operators; Stewart & Lloyds, Glasgow, steel high-pressure pipe; B. F. Sturtevant Co., Galt, Ont., blowers; Sturtevant Engineering Co., England, forges, fans, blowers, etc.; Thermotank Ventilating Co., Glasgow, heating system in all buildings; Vogel Co. of Canada, Ltd. (Estey Bros.), Montreal, fire sprinklers; Woven Steel Hose & Rubber Co., Trenton, N.J., armoured hose.

General Observations.

From a perusal of the preceding article something of the immensity of this Canadian Vickers institution can be realized and appreciated. The fact, however, that such a plant has been established in Canada has a very deep significance. This naval construction works is complete in every detail, so that here a mighty ocean liner can be constructed right from the raw materials.

We Canadians have surely inherited many of the traits which have made Britain a nation of sailors, shipbuilders and traders. We have, in the past, been developing the natural resources of our great country, and have been too busy to build many of our own ships, but now that our trade has commenced to become a factor in the commerce of the world, our interest is being awakened in this great industry.

With the opening of this great institution, Canada has entered upon a new era. A time-honored industry on our shores has been regenerated. Many men will doubtless be imported from the parent plant to guide the destinies of this new Canadian Vickers, Ltd., and these will not only be found on the administrative staff, but also in the various other branches where the application of theories and practices are attended to. Such men have been taught the lessons that experiences of all times have handed down to the Britisher, besides having spent their lives in making themselves skilled in the various spheres of shipbuilding and marine engineering. They will in turn teach us, and in the not too distant future we will be able to point to whole fleets of Canadian-built and manned vessels. Just as closely as railways are identified with our development, so is the development of our sea-going merchant marine.

As the result of recent happenings in the Indian Ocean, Australia's navy has been the recipient of a great deal of our admiration; in some instances amounting almost to envy. Canada in her turn must have a navy and, when that time arrives, she will undoubtedly be in a position to supply not only the raw materials with which to construct every portion of the ship, but the plants in which the ships are to be built, the men to build them and the men to man them.

Our abilities as shipbuilders and sailors have to a large extent been lying dormant, because of other matters which have been, for the moment, apparently more pressing, but those days are rapidly passing into history, and with the advent of the Canadian Vickers, Ltd., into the circle of our numerous industries, we have passed a milestone in the journey of progress toward better, greater development. The seed has been bountifully sown, and there is no limit to the commercial prowess that this institution, as the pioneer naval construction works of sea-going vessels, will make possible to us citizens of this great Dominion.

RECENT BRITISH NAVY ADDITONS.

THE Navy List for January reveals the fact that several vessels have been put into commission since the last list was issued in December. Two light cruisers have been added, these being the Cordelia and the Caroline, the latter being the boat which was built in record time.

These boats have a displacement of about 3,800 tons, and the designed speed is 30 knots, although this can probably be exceeded when required. The machinery installation gives a total indicated horse-power of 40,000, and the boilers are fired by oil fuel only, about 750 tons being carried. Turbine machinery is, of course, installed, and the armament consists of two 6-in. and six 4-in. guns, both being of 50 calibres. There are four 21-in. torpedo tubes above water, one pair on each side.

Six more boats of this class have yet to be put into commission, three of which are listed as building and three as completing. All these vessels are of the 1913 estimates, but there are still four light cruisers of the 1912 estimates to be finished. One of these was completed and commissioned on the 10th December last, this being Penelope, a sister ship to the Arethusa. The Penelope is of very much the same size as the Caroline class, the displacement being 3,600 tons and the draught about 14 feet. The armament is the same, and the power installation is between 36,000 and 37,000 i.h.p., giving the same speed of about 30 knots. All these boats have a 3-in. armoured belt.

Among the destroyers commissioned since the last month's issue of the Navy List are the Matchless, the Mentor, Milne, Morris, and the Murray. These boats probably have a speed of about 35 knots.

NEW TYPE BRITISH SUBMARINE.

ACCORDING to recent Admiralty notices the submarine W8 will shortly be commissioned, with Lieut. B. A. Beal in command. The submarines designated with the letter W were built by Armstrong-Whitworth & Co. at Elswick, and are of the Laubeuf type of design originated by the well-known French engineer of that name. They differ from the ordinary British submarines in that they have a greater reserve buoyancy, and are more of submersibles than submarines. It was understood that there were only four of these boats to be constructed, and the names given to them were W1 to W4. The meaning of W8, therefore, is not quite clear. These vessels were generally believed to be comparatively small craft of about 500 tons, although their speed is probably quite high.

The difference between this type of craft and the ordinary Vickers design (such as is followed in practically all other British submarines) lies in the variation mentioned above in the reserve buoyancy—that is to say, the difference between the submerged and the surface displacement. In the ordinary British submarine of the largest type, having a submerged displacement of 810 tons, the surface displacement is about 720 tons, leaving a reserve buoyancy of 90 tons, or about 11 per cent. In the Laubeuf type of submarine, whilst the submerged tonnage is 550, the surface displacement is only 400 tons, giving a reserve buoyancy of 27 per cent.

It is generally considered in France that this large reserve buoyancy is a necessity for good sea-going qualities and, as in spite of the relatively small size, many or more torpedo tubes can be carried in these boats and their speed is equal to the larger craft, they may be considered quite as valuable as any of the other vessels.

Canadian Rules for Steamship Life Saving Appliances

No Revision of Rules for Life-Saving Appliances Having Been made for Some Years by the Department of Marine and Fisheries, and Those at Present in Force Being Below the Standard Required by Other Governments as Regards Foreign Going Ships it Has Been Determined by a Recent Order-in-Council That the Rules Which Have Constituted the Substance of These Articles Will Become Effective as From April 1, 1915.

GENERAL RULES.—III.

THE two opening paragraphs of this, the third and final portion of the revised Canadian rules relative to steamship life-saving appliances, deal further with the boat-lowering apparatus section which appeared in our January issue.

(6) Where more boats than one are served by the same set of davits, arrangements shall be made to prevent the falls fouling when they are recovered, and where more than three boats are served by the same set of davits there shall be provided an approved appliance for lowering the boats in turn and rapidly.

(7) The Board may accept in lieu of davits or sets of davits any other appliance, appliances, or arrangements, which appear to them at least as effective as davits for placing the boats in the water.

14. *Equipment for Boats and Life-Rafts.*

(1) Every boat which is carried by any ship shall be equipped as follows:—

(a) With the full single banked complement of oars and two spare oars, and a steering-oar.

(b) With two plugs for each plug hole, attached with lanyards or chains, and one set and a half of thole pins or crutches, attached to the boat by sound lanyards. Plugs shall not be required where proper automatic valves are fitted.

(c) With a bailer, a galvanized iron bucket, a rudder, and a tiller or yoke and yoke lines, a painter of sufficient length, and a boat-hook. The rudder, the bailer, and the bucket shall be attached to the boat by sufficiently long lanyards, and kept ready for use.

(d) In a ship navigating in salt water, with a vessel capable of holding one quart for each person that the boat is deemed fit to carry. This vessel shall be kept filled with fresh water, and provided with a dipper with lanyard.

(e) With two hatchets, one to be kept in each end of the boat, and to be attached to the boat by a lanyard.

(f) With a line securely becketed round the outside of the boat.

(g) With an efficient lantern, trimmed, with oil in its receiver sufficient to burn eight hours; or with some other lantern or light at least as effective approved by the Board.

(2.) In addition to the equipment prescribed above, the boats in all Classes of foreign-going ships shall be equipped as provided in paragraphs (a) to (e), inclusive, of this sub-section of this Rule. The Board may, however, exempt from the requirement to carry masts, sails, and compasses a proportion of the boats of ships which carry passengers in the North Atlantic, and which are equipped with wireless telegraphy. The boats of ships in Classes I and II of the Coasting and Inland Trade, and ships of Class IV Coasting and Inland Trade which proceed to sea beyond the limits of sheltered waters, shall be provided with the additional equipment specified in paragraphs (b), (d), and (e) of this sub-section of this Rule.

(a) With a mast or masts, and with at least one good sail and proper gear for each; but this does not apply to an approved motor boat.

(b) With an efficient compass.

(c) With an air-tight case containing 2 pounds of biscuits for each person for whom the boat is approved.

(d) With a sea anchor and one gallon of vegetable or animal oil, with a vessel of approved pattern for distributing it on the water in rough weather. This vessel shall be capable of being attached to the sea anchor.

(e) With one dozen self-igniting red lights in a water-tight tin, and a box of suitable matches in a water-tight tin.

(3.) Every life-raft, which is carried by a foreign-going ship, shall be equipped as follows:—

(a) With five oars and five thole pins or crutches attached to the raft by sound lanyards, and a steering oar.

(b) With a sea anchor and a painter of sufficient length.

(c) With a vessel capable of holding one quart for each person that the raft is deemed fit to carry. This vessel shall be kept filled with fresh water and provided with a dipper with lanyard.

(d) With a line securely becketed round the outside of the raft.

(e) With a self-igniting lifebuoy light.

(f) With one gallon of vegetable or animal oil, and a vessel of approved pattern for distributing it on the water on rough weather. This vessel shall be capable of being attached to the sea anchor.

(g) With an air-tight case containing two pounds of biscuits for each person for whom the raft is approved.

(h) With one dozen self-igniting red lights in a water-tight tin, and a box of suitable matches in a water-tight tin.

(4) Every life-raft which is carried by a ship, other than a foreign-going ship, shall be provided with a suitable approved equipment.

(5) All boats and rafts shall be fully equipped before the ship leaves harbor, and the equipment shall remain in the boat or raft throughout the voyage while the ship is at sea. Such of the articles as are liable to be stolen or mislaid shall be properly secured to the boat or raft. If it is not practicable to place the whole of the equipment in the boat or raft the part not so placed shall be stowed in a suitable locker near by, and each article shall be marked with the number of the boat or raft to which it belongs.

15. *Buoyant Apparatus.*

Approved buoyant apparatus, whether buoyant deck seats, buoyant deck chairs or other buoyant apparatus, shall be deemed sufficient, so far as buoyancy is concerned, for a person or a number of persons to be ascertained by dividing the number of pounds of iron which it is capable of supporting in fresh water by 32. Such buoyant apparatus shall be of approved material and construction, and if it depend for its buoyancy on air shall not require to be inflated before use, and shall be marked in such a way as plainly to indicate that it is buoyant and the number of persons for which it is approved. If necessary, a suitable life-line shall be properly attached to all approved buoyant apparatus.

16. *Life-Jackets.*

An approved life-jacket shall mean a jacket of approved material and construction, which is capable of floating in fresh water for 24 hours with 15 pounds of iron suspended from it, or any other approved appliance of equal buoyancy and capable of being fitted on the body. Life-jackets the buoyancy of which depends on air compartments are prohibited. Life-jackets for children shall be of suitable size and buoyancy to the satisfaction of the Board.

17. *Lifebuoys.*

(1) (a) An approved lifebuoy shall be of solid cork or other equivalent material. It shall be capable of floating in fresh water for at least 24 hours with 32 pounds of iron suspended from it.

(b) Lifebuoys filled with rushes, cork shavings, granulated cork or any other loose granulated material, or whose buoyancy depends upon air compartments requiring inflation, are prohibited.

(2) All lifebuoys shall be fitted with beckets securely seized and at least one on each side of the vessel shall be fitted with a life-line at least 15 fathoms in length.

(3) In all ships, other than those in Classes III of the Coasting or Inland Trade, at least half the lifebuoys required in any ship shall have placed near them with proper means for attachment to them, efficient self-igniting lifebuoy lights inextinguishable in water, to the satisfaction of the Board.

(4) Ships in Class IV Coasting or Inland Trade need not be provided with lifebuoy lights except when they are certified to proceed beyond the limits of sheltered waters.

18. *Position of Lifebuoys and Life-Jackets.*

All lifebuoys and life-jackets shall be suitably placed to the satisfaction of an Inspector, and so as to be readily accessible to all persons on board; and their position shall be plainly indicated so that it may be known to those for whom they are intended.

Lifebuoys shall always be capable of being rapidly cast loose and shall not be rigidly secured in any way.

19. *Saving for Certain Boats.*

(1.) Any boat which forms part of the equipment of a ship in the Coasting or Inland Trade that was launched before the 1st April, 1915, and which has been inspected and found to be in accordance with the regulations in force prior to that date may be accepted as equivalent to a life-boat until the 1st April, 1917, so long as it remains in good condition.

(2.) Boats which were ordered before the 1st November, 1914, in order to complete the equipment of a ship but which were not delivered in sufficient time to be inspected and accepted as part of a ship's equipment before the 1st April, 1915, may be accepted as lifeboats until the 1st April, 1917, so long as they remain in good condition, provided they are inspected and found to comply with the regulations in force prior to that date.

20. *Exemptions.*

(1.) If it appear to the Board, on the application of the owner of any ship, that it is not practicable or reasonable to fit in that ship the number of sets of davits required by these Rules, the Board may direct that one or more sets of davits may be dispensed with in that ship, subject to such conditions, if any, as the Board may require.

Provided that, in the case of a foreign-going passenger steamship, the number of sets of davits fitted shall not be less than the minimum number of open boats of Class 1 required by these Rules, except in the following cases:—

(i) If a large proportion of the persons on board are accommodated in boats whose length is greater than 50 feet, a further reduction in the number of sets of davits may be allowed, if the Board are satisfied that the arrangements are in all respects satisfactory.

(ii) In the case of ships the keel of which is laid on or before the 31st December, 1914, the minimum number of sets of davits may, if the ship is between 245 feet and 460 feet in length, be one less, and if the ship is 460 feet or more in length, two less (one on each side of the ship), than the minimum number of open boats specified in Column B of the Table in Appendix I.

Provided further that, in the case of a foreign-going passenger steamship, the owner of the ship in question shall be required to prove, by a test made in the presence of an Inspector, that all the boats can be launched in a time, to be fixed by the Board. The conditions of this test shall be as follows:—

(a) The ship is to be upright and in smooth water.

(b) The time is the time required from the beginning of the removal of the boat covers, or any other operation necessary to prepare the boats for lowering, until the last boat or pontoon raft, is afloat.

(c) The number of men employed in the whole operation must not exceed the total number of boat hands that will be carried on the vessel under normal service conditions.

(d) Each boat when being lowered must have on board at least two men, and its full equipment as required by these Rules.

The Board may in their discretion impose as a condition of such exemption as aforesaid, in respect of a ship in Class I of the Coasting or Inland Trade, launched before the 1st April, 1915, that the boats carried shall be of such size as will give the total cubic capacity as shown in the Table in Appendix II.

(2) If it appear to the Board, on the application of the owner of any ship, that it is not practicable or reasonable in a particular case to require that pontoon lifeboats, made before the 31st December, 1914, and carried on ships of which the keel was laid on or before that date, shall have the minimum freeboard specified in these Rules, or the bottom and deck made in two thicknesses with textile material between, the Board may in their discretion dispense with full compliance with the Rules in these respects until the 1st January, 1920, subject to such conditions, if any, as the Board may impose.

(3) If it appear to the Board on the application of the owner of any passenger steamship in the Coasting or Inland Trade, launched before the 1st April, 1915, that it is not practicable, or reasonable, to provide in that ship the boats, approved life-rafts, approved buoyant deck seats, or other approved buoyant apparatus required, the Board may direct that the requirements of these Rules may be modified as regards that ship, subject to such conditions as they may impose, provided always that,—

(a) In the case of a ship in Class I or Class II of the Coasting Trade or Class I of the Inland Trade, the total number of persons which can be accommodated in the boats, approved life-rafts, approved buoyant deck seats, or other approved buoyant apparatus, shall not be less than 70 per cent. of the total number allowed to be carried by the ordinary pessenger certificate. In the case of a ship in Class II of the Inland Trade, the total number of persons which can be accommodated shall not be less than 40 per cent. of the total number allowed to be carried by the ordinary passenger certificate.

(b) In the case of a ship in Class III of the Coasting Trade or Class III of the Inland Trade, the total number of persons which can be accommodated by the boats, approved life-rafts, approved buoyant deck-seats, or other approved buoyant apparatus, shall not be a lower percentage of the total number of persons which the ship is certified to carry than:

In Class III, Coasting Trade, 50 per cent.
In Class III, Inland Trade, 30 per cent.

(c) Where in any case in the Coasting or Inland Trade, for steamships launched before the 1st April, 1915, the total cubic capacity of boats, as shown in the tables in Appendices II, III and IV, is allowed to be reduced, a condition of such reduction shall be that approved life-rafts be fitted with a total carrying capacity at least equal to that of the boats not provided.

(d) Notwithstanding any exemptions allowed, the full number of lifebuoys and life-jackets, required in accordance with the Rules for the respective classes of steamships, shall be carried.

21. *Passenger Vessels, Towed.*

Where passengers are carried in any vessel towed by a steamship, the vessel towed shall, for the purpose of these rules, be treated as a steamship and shall be equipped with boats, buoyant apparatus, and other life-saving appliances accordingly.

22. *Reference to General Rules.*

When in a Rule in any class reference is made to a General Rule, that refer-

ence shall not be deemed in any way to limit or to derogate from the general force and application of the Rule to which reference is made.

Appendix I.

Table showing the Minimum Number of Sets of Davits and the Minimum Number of Open Boats required to be provided in a steamship in Class I, Foreign-going, or in Class I, Coasting Trade, or in Class II, Coasting Trade (except in certain cases), or Class I, Inland Trade, and the Minimum Life-boat Capacity for the purposes of General Rule 2.

Registered Length of the Ship.			(A) Minimum number of sets of davits.	(B) Minimum number of open boats, Class 1.	(C) Minimum aggregate cub. cap'y of lifeboats in feet.
Ft.					
Under			120.. 2	2	980
120	and	under	140.. 2	2	1,220
140	"	"	160.. 2	2	1,550
160	"	"	175.. 3	3	1,880
175	"	"	190.. 3	3	2,390
190	"	"	205.. 4	4	2,740
205	"	"	220.. 4	4	3,330
220	"	"	230.. 5	4	3,900
230	"	"	245.. 5	4	4,560
245	"	"	255.. 6	5	5,100
255	"	"	270.. 6	5	5,640
270	"	"	285.. 7	5	6,190
285	"	"	300.. 7	5	6,930
300	"	"	315.. 8	6	7,550
315	"	"	330.. 8	6	8,290
330	"	"	350.. 9	7	9,000
350	"	"	370.. 9	7	9,630
370	"	"	390.. 10	7	10,650
390	"	"	410.. 10	7	11,700
410	"	"	435.. 12	9	13,060
435	"	"	460.. 12	9	14,430
460	"	"	490.. 14	10	15,920
490	"	"	520.. 14	10	17,310
520	"	"	550.. 16	12	18,720
550	"	"	580.. 16	12	20,350
580	"	"	610.. 18	13	21,900
610	"	"	640.. 18	13	23,700
640	"	"	670.. 20	14	25,350
670	"	"	700.. 20	14	27,050
700	"	"	730.. 22	15	28,560
730	"	"	760.. 22	15	30,180
760	"	"	790.. 24	17	32,100
790	"	"	820.. 24	17	34,350
820	"	"	855.. 26	18	36,450
855	"	"	890.. 26	18	38,750
890	"	"	925.. 28	19	41,000
925	"	"	960.. 28	19	43,880
960	"	"	995.. 30	20	46,350
995	"	"	1,030.. 30	20	48,750

When the length of the ship exceeds 1,030 feet the Board shall prescribe the minimum number of sets of davits and the minimum number of open boats.

Appendix II.

Table showing the Minimum Aggregate Cubic Capacity of Lifeboats to be carried in a ship in Class I, Coasting Trade, launched on or after the 1st day of April, 1915, or in Class II Coasting Trade (except in certain cases), or Class I, Inland Trade, launched after that date.

Length of vessel in feet.			Minimum aggregate capacity of lifeboats, in cubic feet.
100	and	under 120.....	400
120	"	" 140.....	600
140	"	" 160.....	850
160	"	" 175.....	1,150
175	"	" 190.....	1,300
190	"	" 205.....	1,450
205	"	" 220.....	1,600
220	"	" 245.....	1,850
245	"	" 270.....	2,350
270	"	" 300.....	3,000
300	"	" 330.....	3,750
330	"	" 370.....	4,400
370	"	" 410.....	5,100
410	"	" 460.....	6,000

In the case of a steamship of under 100 feet, or over 460 feet, the capacity of the lifeboats to be carried shall be prescribed by the Board.

Appendix III.

Table showing the Minimum Number of Sets of Davits and the Minimum Aggregate Cubic Capacity of Lifeboats to be carried in a Steamship in Class II, Coasting Trade (in certain cases), and in Class II, Inland Trade.

Length of Steamship in feet.			Minimum Number of Sets of Davits.	Minimum aggregate capacity of lifeboats in cubic ft.
60	and	under 100	2	250
100	"	" 120	2	300
120	"	" 140	2	400
140	"	" 160	2	500
160	"	" 180	2	600
180	"	" 195	3	700
195	"	" 210	3	800
210	"	" 225	4	950
225	"	" 240	4	1,080
240	"	" 255	5	1,250
255	"	" 270	5	1,450
270	"	" 285	6	1,700
285	"	" 300	6	1,900
300	"	" 330	7	2,150
330	"	" 360	8	2,400

In the case of a steamship over 360 feet in length the number of sets of davits and the cubic capacity of the lifeboats to be carried shall be prescribed by the Board, as shall be the case for a ship of less than 60 feet in length in Class II, Coasting.

Appendix IV.

Table showing the Minimum Number of Sets of Davits and the Minimum Aggregate Cubic Capacity of Boats required to be provided in a Steamship in Class III, Coasting Trade, or Class III, Inland Trade.

Length of Steamship in feet.			Minimum Number of Sets of Davits.	Minimum aggregate capacity of boats in cubic ft.
60	and	under 100	2	180
100	"	" 125	2	240
125	"	" 150	2	300
150	"	" 175	2	400
175	"	" 200	4	480
200	"	" 225	4	600
225	"	" 250	4	800

In the case of a steamship over 250 feet in length, the number of sets of davits and minimum aggregate cubic capacity of lifeboats shall be prescribed by the Board.

A CHIP OFF THE OLD BLOCK

Courtesy *"Punch"*

The Development of a Four Piece Ship's Ventilator Cowl

By J. W. Ross

The very practical piece of development and layout work herein described, although the direct answer to a query from one of our subscribers, if well studied and understood, will be found to cover a wide field of sheet metal problems. The practice as set forth is applicable to many forms of irregular pipe bends and junctions and illustrates some distinct advantages of longitudinal over girth seams. The construction applies to a 20-inch pipe cowl.

FIG. 1 shows a ventilator cowl built up of four pieces with vertical seams. This type of cowl is much preferable from its visual effect to that made up with girth seams, and where pleasure yachts, passenger vessels and Government or naval craft are concerned the plate arrangement here featured is usually insisted upon. Fig. 2 illustrates the construction of the cowl, the layout of which may be drawn to any desired scale, or be made apply to any required size pipe.

Measure off A B equal to 20 inches, bisect at P and raise the vertical line V P equal to 40 inches. Draw the overhang V C at right angles to P V and equal to 18½ inches. With E as centre and radius (equal to 25 inches) draw in the arc C K F J so as to be tangent to the perpendicular A J raised from A B. Raise the perpendicular B L M.

Locate the point G, which is 4 inches above the line A B and 2 inches from B L M. With G as centre and 2 inches radius, strike the quadrant M N D tangent to B L M. Directly above the point G locate D, which is on the quadrant M N D. Connect by a straight line the points D and C, thus completing the outline of the cowl. Now divide the back into four equal parts as shown by A J F K C. Similarly divide the throat sheet line into the same number of equal parts as shown by the points B L M N, and D. Connect these points by straight lines to their relative points on the back sheet line, as J L, F M, K N. These lines will be used as sectional planes and on them will be constructed the half sectional views.

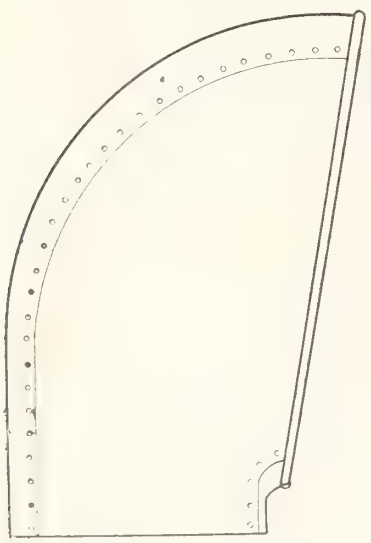


FIG. 1. VENTILATOR COWL WITH VERTICAL SEAMING.

With P as centre and radius P A, strike the semicircle A P° B, thus defining the half-sectional view through the plane A B. Bisect J L at Q, then with Q as centre and radius Q J strike the semicircle J Q° L. Again, with R as centre, describe the semi-circle F R° M. Similarly with S K and T C as radii, strike the half section views K S° N and C T° D, respectively.

It is the usual practice in this type of cowl to make the back and throat sheets each equal to one-sixth of the circumference and the side sheets each equal to two-sixths. On this principle, our patterns and templets will be developed. Divide the semi-circle A P° B into exactly six equal parts and locate the end points 1° and 2°. At right angles to A B project the lines 1° 1 and 2° 2, thus locating the points for the rivet lines. Divide the arc J Q° L into six equal parts, the extreme points 3° and 4° being projected at right angles to the plane J Q L, thus locating the rivet line points 3 and 4. Similarly, the arcs F R° M, K S° N and C T° D are each divided into six equal parts, their extreme division points being projected at right angles to their respective planes, thus locating the rivet points 5 6 7 8 9 and 10.

Erect the perpendicular 1 3 to the line A B, and with a suitable centre as at U, and radius U 9, describe an arc through the located points 9 7 5, and tangent to the perpendicular 1 3. The line 1 3 5 7 and 9 defines the rivet line for the back and side sheets. The rivet line for the throat and side sheets is drawn in a similar manner. Erect the perpendicular 2 6, and with a suitable centre draw the arc cutting through the points 6 8 4 and 10, and tangent 2 6.

For the development of the back sheet, take the distances A J, J F, F K and K C, transfer over to Fig. 3 and locate the points A J F K C on the straight line A C. Draw lines at right angles to A C through all these points. Measure off carefully along the curve the distance A 1°, Fig. 2, and transfer this over to Fig. 3 by measuring at each side of 1, locating the points 1° 1°, which will be equal to one-sixth of the circumference, through the plane having A B as diameter. Similarly measure J 3°, Fig. 2, and transfer to J 3°, Fig. 3. Again,

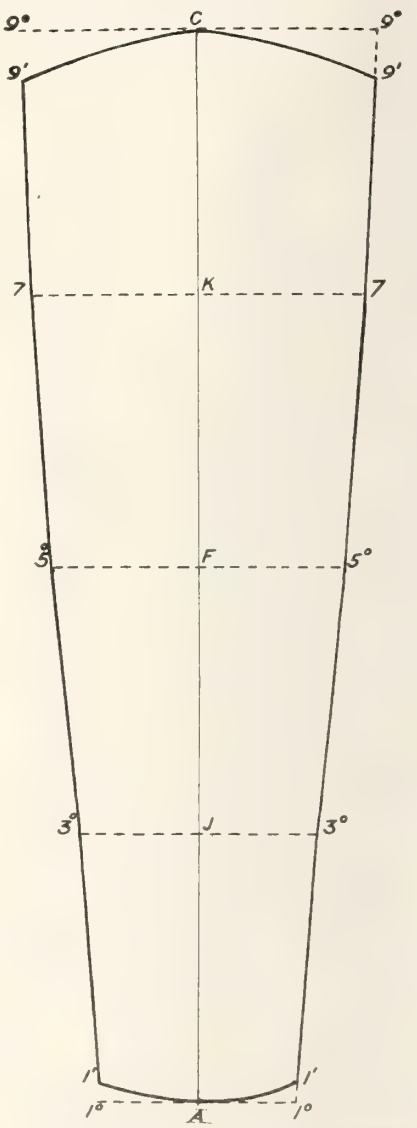


FIG. 3. DEVELOPMENT OF BACK SHEET.

transferring all the distances as F 5°, K 7° and C 9°, measured along the curve (or calculated), Fig. 2, to their respective locations in Fig. 3, an even curve is drawn in through these points by the aid of a flexible batten.

It will be observed that in Fig. 2 the line 1 3 5 7 9 is shorter than the line A J F K C; this, then, will have to be shown in Fig. 3. From the located point

E, draw a straight line to F, locating the point F^1 where this line intersects the rivet line, Fig. 3. Measure carefully along the curve from this point F^1 to the point 9. This distance is then measured from 5° to 9^1 in Fig. 3. The distance F^1 to 1, Fig. 2, is next transferred to Fig. 3 as from 5° to 1^1. Suitable curves are drawn through the points 9^1 C 9^1 and 1^1 A 1^1 respectively. This completes the templet for the back sheet; laps, of course, to be added as required. If the reader is in doubt about the curves 9^1 C 9^1 and 1^1 A 1^1, perhaps it would be just as well to prolong the rivet line from 9^1 to 9° and from 1^1 to 1°, thus leaving the ends square. It will require in any case to be "dressed" after being "blocked" or hollowed out.

The throat sheet is developed in a manner similar to the back sheet. The distances in Fig. 2, B L and L M, M N and N D measured along the curve, are transferred over to Fig. 4 and located on the straight line by the points B L M N D. Parallel lines at right angles to B D are drawn through these points. In Fig. 4, B 2° is made equal to B 2°, Fig. 2, which is also equal to A 1°, Figs. 2 and 3. Again, L 4°, Fig. 4, is made equal to L 4°, Fig. 2. Similarly the distance M 6°, N 8°, D 10°, Fig. 2, are transferred over to their respective positions in Fig. 4. It will be observed that the distances B 2°, L 4°, M 6°, etc., Fig. 4, are equal to the distances respectively A 1°, J 3°, F 5°, etc., in Fig. 3. Through these located points draw an even curve with the flexible wooden batten, as was done in Fig. 3.

It will be noticed that the rivet line 2 4 6 8 10, Fig. 2, is longer than the outline B L M N D. This extra length must be added on to the rivet line in Fig. 4. From the point G, through the centre of the quadrant M N D, draw the line G H. Measure from D to this intersection point on the quadrant, and transfer this distance over to Fig. 4, thus locating the line G H. From G^1, measured along the curve to 10, Fig. 2, transfer this distance to Fig. 4 by measuring from the line G H to 10^1. Similarly, transfer the distance G^1 to 2, Fig. 2, over to Fig. 4 as from the line G H to 2^1. Connect the points 2^1 B 1^1 and 10^1 D 10^1 each by suitable curves.

Fig. 4 shows the templet for the throat sheet, suitable laps to be added. The side sheets are developed in a slightly different manner. Transfer the outline of the side sheet as shown by 1 3 5 7 9 10 8 6 4 2, Fig. 2, to the similarly numbered outline in Fig. 5. Connect the points 1 P 2, 2 Q 4, 5 R 6, etc., Fig. 5, similar to Fig. 2. Measure off P 1" and P 2", Fig. 5, each equal to 1/6 of the circumference of which 2 B^1, Fig. 2, is the diameter, or measure along the semicircle the distance 1° 2°, Fig. 2, and place half of this at each side of point P, Fig. 5, to locate the points 1"and 2".

Calculate or measure off half the distance along the arc of 3° to 4°, Fig. 2, and place this distance at each side of the centre Q on line 3 Q 4, thus locating 3^2 and 4^2 in Fig. 5. Again, take the length of the arc 5° 6°, Fig. 2, and place half of this on each side of R on the extended line 5^2 R 6^2 to locate the points 5^2 and 6^2, Fig. 5. Similarly transfer the distances 7° 8° and 9° 8°, Fig. 2, to their relative positions to locate the points 7^2 9^1, and 8^2 10". Connect the points 1" 3^2 5^2 7^2 9^1 and 2" 4^2 6^2 8^2 10", as shown in Fig. 5. . Measure the length of the line 1 3 5 7 and 9 and also the line 1" 3^2 5^2 7^2 and 9^1. Take half the distance between these two lengths and locate the points 9^2 and 1^2 by measuring from 9^1 and 1" respectively. Similarly measure to find out how much longer the line 2 4 6 8 10 is than the line 2" 4^2 6^2 8^2". Take this difference and add half from $10^"$ to 10^2 and half from 2" to 2^2. Connect 1^2 to 2^2 to locate the outline for the bottom of the side sheet.

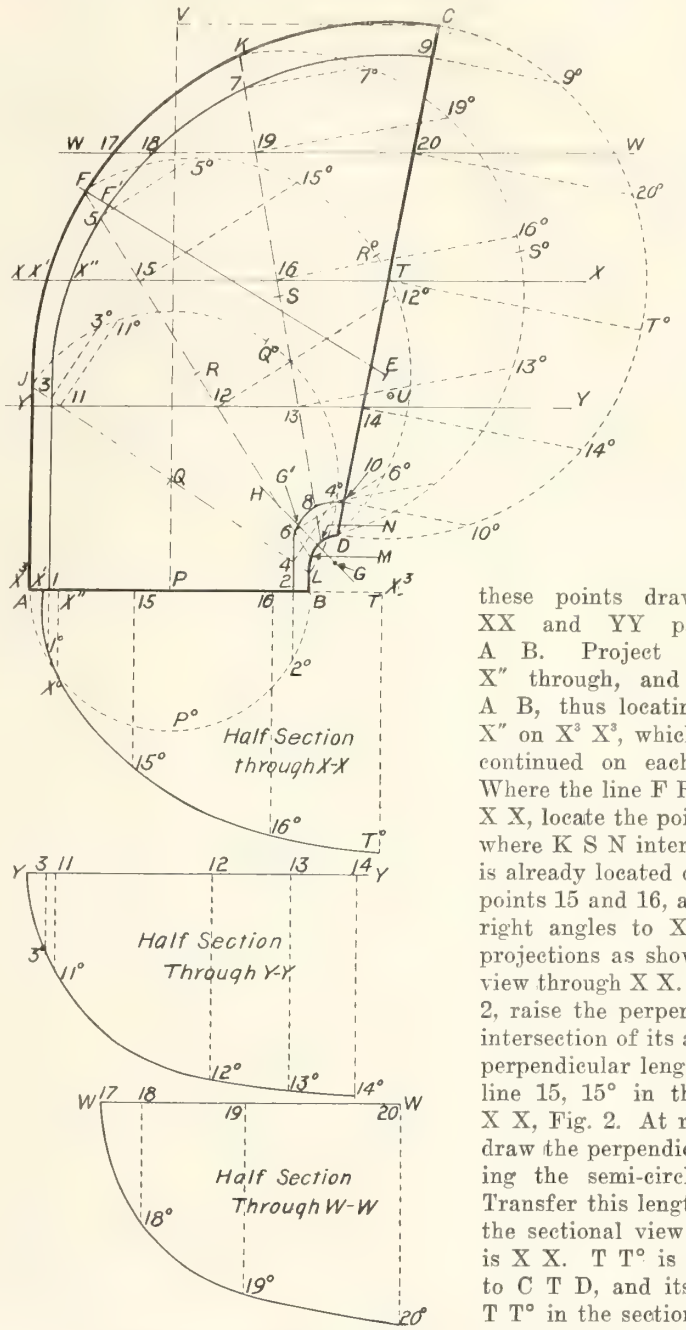


FIG. 2. GENERAL ANALYSIS OF VENTILATOR COWL CONSTRUCTION.

To obtain the curved line 9^1 to 10^2, it is necessary to find out the points W" T^1 and Y". This is done in the following manner: Divide C D, Fig. 2, into four equal parts, and through these points draw the planes W W XX and YY parallel to the line A B. Project the points X^1 and X" through, and at right angles to A B, thus locating the points X^1 and X" on X^3 X^3, which is shown on, and is continued on each side of A and B. Where the line F R M intersects the line X X, locate the point 15. Also locate 16 where K S N intersects the line X X. T is already located on X X. Project these points 15 and 16, and T, down to, and at right angles to X^3 X^3. Continue these projections as shown in the half section view through X X. On the elevation, Fig. 2, raise the perpendicular 15, 15° to its intersection of its arc F R° M. Take this perpendicular length and transfer to the line 15, 15° in the half-sectional view X X, Fig. 2. At right angles to K S N draw the perpendicular 16, 16° intersecting the semi-circle K S° N at 16°. Transfer this length 16, 16° to 16 16° in the sectional view for this plane, which is X X. T T° is drawn at right angles to C T D, and its length transfered to T T° in the sectional view.

The distance X" X° in the sectional view is equal to the distance through X" on the line X X in the elevation. This distance is not shown in the elevation view, but it is obtained by using a little judgment. The distance through the point 5 is equal to 5 5° and through the point 3 is equal to 3 3°, so if X" was midway between the points 3 and 5, it would be equal to the mean of the two distances 3 3° and 5 5°. But X" is nearer to 5 than 3, so it will be seen that it is not difficult to get the distance X" X° for the cross-section. An even curve drawn through the points T° 16° 15° 5° and X^1, in the section view, will define the half section for the plane X X.

The sections for Y Y and W W are constructed in a similar manner.

The plane lines W W, X X and Y Y in Fig. 2 are transferred over to their proper positions in Fig. 5. The distance X° 15° 16° and T° in the sectional view, Fig. 2, is equal to the curve of the side

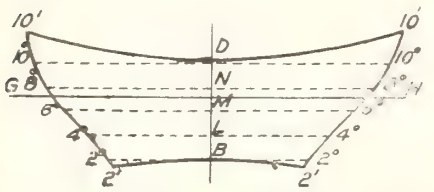


FIG. 4. TEMPLET FOR THROAT SHEET.

sheet; it is therefore transferred over to Fig. 5, measuring from the point X^4 along the line X X to the point T^1. With the three points 9^2, T^1 and 10^2 located, the curve may be drawn in by a flexible batten. The points W″ and Y″ on this curve are located by taking the length of the curve 3° 11° 12° 13° and 14°, Fig. 2, and measuring this along the line Y Y, Fig. 5, from the point Y^1 to locate Y″. To locate W″, the distance 18° 19° and 20°, Fig. 2, is measured from W^1 along the line W W, Fig. 5. Five points are shown to locate the curve 9^2 W″ T^1 Y″ and 10^2 and, although three points would be quite sufficient, the number is left to the option of the reader. If three points are chosen it will be then only necessary to construct the cross sectional view through X X in Fig. 2.

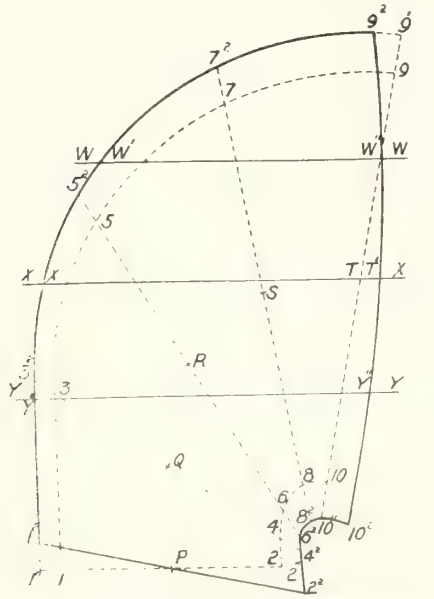


FIG. 5. DEVELOPMENT OF TEMPLETS FOR SIDE SHEETS.

The heavy lines in Fig. 5 show outline of the templet, minus the laps, for the side sheet.

Sets or gauges of the sections of the various planes will be used for trying out the templets, during the process of hollowing or blocking out.

The continuation of the cowl below the line A B is a straight cylinder and is developed as such. This cylindrical course is, of course, fitted inside the cowl for water-shed purposes, using the line A B as the girth seam line.

HEROES OF THE STOKEHOLD.

WHEN British sea successes are being acclaimed, rarely, if ever, do we hear mention made of the work of the grimy heroes of the stokehold—men whose work is vitally essential to the success of a naval action, and who at all times are environed by an atmosphere of peril and risk. The honor of performing the "lion's share" aboard our modern men-of-war undoubtedly belongs to the hard-working stoker, whose merits too often go unrecognized when honors and rewards are being dealt out after a successful "scrap" with the enemy.

It is a mistake to suppose that a stoker spends his whole time stoking. True, this is his chief function, but he is also constantly employed in attending to the many auxiliary engines in a warship. The ventilating plant, the fire and bilge pumps, the dynamos, etc., are all attended by stokers, who are also in charge of the machinery of the steam cutters and launches, etc., of the ship; these men being generally of the rating of chief stoker. Therefore, it is quite correct to regard stokers as partially skilled engineers, and not purely as men who handle the shovel. The majority, however, are not employed on any special work, such as we have mentioned, but in the stokehold, and probably the nature of no other work in the navy is so little understood by the average landsman.

It is easy enough to sum up the labor of the stokers down below as shoveling coal on the fires, and imagine you have hit the mark; but the awful physical strain and endurance which such work requires cannot be gauged by one who has not watched the men at their work or tried his hand at it himself. Their work is unquestionably the most arduous of any branch afloat.

Behind the Scenes.

Figure the boiler-room of a modern cruiser when she is doing her hardest. Forty-eight Belleville boilers arranged in six nests athwartships are keeping her steel pulse palpitating to the tune of 30,000 indicated horse-power. The safety valves must be held to the verge of rising, which means that the pressure gauge points to 300 lb. on the square inch. Twenty tons of coal an hour have to be fed into the glaring furnaces, and the passage of 70 gallons of water per minute through the condensers regulated to a nicety. Stripped to the waist, and wearing only a pair of loose "Fearnought" trousers, the stoker bravely faces the roaring furnaces as he skilfully shoots shovelful after shovelful of coal into the white heart of the glowing interior, his body all dripping and shining with perspiration.

In tropical countries matters are even worse. On deck the seaman loudly complains of the stifling atmosphere. His face is burnt red or brown by the fierce rays of the sun, the brightly-polished rails and stanchions are red-hot to the touch, and the pitch bubbles merrily between the deck planks, sticking to the bare feet of the sailors. All this while the stoker is caged below. The stokehold, bad enough in a temperate climate, is now indescribable. The seaman on deck does very little work during the hotter hours of the day, but the luckless stoker sweats and slaves no matter how high may be the thermometer.

In many warships the trials of the stokers are increased by the fact that the boilers are not always alike even in the same ship, while in the navy altogether there are over ten different types. Each boiler has a distinct temperament of its own. Its whims must be humored, or there will be trouble. One boiler may be intensely volatile and need coaxing from its dangerous tendency to undue expansion and contraction by centre firing. Another may be moodily sluggish, requiring to be fiercely stoked in its every corner to hold its pressure. Then the gauge glasses must be watched. The bubbling beads must never be allowed to go beneath a certain level, else the screech of a volleyed plug will give its shrill warning. They must not be allowed to rise beyond a certain point or priming will result.

The Stoker's Risks.

The stoker is ever on the border line of danger and death. The flying of a fusible plug, the collapse of a boiler tube, the sundering of a steam pipe, or the splintering of a gauge glass may be the start of another "awful calamity. There are chances in the boiler and engine-room spaces which are almost beyond calculation.

Hard work under the unpleasant—to put it mildly—conditions which we have described would of itself alone be highly trying to human nature, but it must be remembered that the work is performed right down in the hull of the ship, with all means of egress securely shut by water-tight doors. In battle the stokers would be the last to know if anything happened, and they have the least chance of escape of any in the ship. It is this terrible sense of uncertainty which puts the morals and discipline of the stokers to a strain which those working on deck never experience. During action, although the work would be done under such a pressure as to make thinking almost impossible, yet those below

the armored deck must be constantly haunted with the sense of the dreadful fate which would overtake them should their vessel be torpedoed or sunk.

An Actual Experience.

An idea of what it means to be in the stokehold of a ship during an engagement is given in a letter by one of the "black squad" who was on the Laurel in the fighting off Heligoland:—

"We could hear the awful din around and the scampering of the tars on deck as they rushed about from point to point, and we know what was to the fore when we caught odd glimpses of the stretcher-bearers with their ghastly burdens. We heard the shells crashing against the sides of the ship or shrieking overhead as they passed harmlessly into the water, and we knew that at any moment one might strike us in a vital part and send us below, never to come up again. It is ten times harder on the men whose duty is in the engine-room than for those on deck taking part in the fighting, for they at least have the excitement of the fight, and if the ship is struck they have more than a sporting chance of escape. We have none, and the medals and the pats on the back when the fight is won are not for us, who are only common mechanics. . . . The cries of the German sailors in the water which reached the engine-room were pitiful. A fair number were saved, but if you look at the ratings you will see that very few of the 'black squad' on their ships got away, which goes to prove my case, that it is not always the man in fighting dress who runs the biggest risk."

The stokers most certainly do not get the public appreciation due to them. The popular idol is the man behind the gun, not the man with the shovel, and yet the one is quite as essential to a modern navy as the other. Good shooting is undoubtedly an asset which it is impossible to over-estimate when it comes to fighting the enemy, but it is well to remember that it is the health, efficiency, and endurance of the rather-forgotten hero of the stokehold that makes the defeat of the enemy practical politics. G. W. H.

Dominion Wreck Commission Investigations

Following the proceedings of a vessel stranding or collision inquiry is fascinating alike to the mariner and landsman. Much food for thought is always available, and in not a few instances it seems well nigh impossible to reconcile our conception of disaster prevention achievement when confronted with a detailed recital of the circumstances which contribute to many marine tragedies.

S.S. "NAVARRA" STRANDING.

A FORMAL investigation into the stranding of the British steamship Navarra on or near Holmes Island, N.S., on or about December 30, 1914, was held at Yarmouth, N.S., on January 7 and 8, 1915, before Captain L. A. Demers, Dominion Wreck Commissioner, assisted by Captain B. R. Hilton and Captain John W. Anderson, acting as nautical assessors, with Edgar N. Clements representing the master of the vessel.

The s.s. Navarra, built in 1909, was a steel vessel of 2,847 tons net and 4,387 tons gross, capable of making 8 to 8½ knots, and owned by Donald & Taylor, of Glasgow. She was under charter to the British Admiralty and left St. John on the morning of December 29, loaded with hay and oats and some 800 bobsleds for the use of the allied troops in France. She was bound for Havre. She carried a crew of thirty hands, all told, including master, first and second officers, duly certificated. She was equipped with all the necessary instruments for her proper navigation, but her last adjustment of compasses took place in 1910.

Pilot's Evidence.

The first witness examined was Alfred Cline, a St. John pilot, who testified that when he boarded and left the vessel the captain and other officers were absolutely sober; that he did not notice whether the compass was correct or not, as he did not have occasion to look at it, as he navigated the ship by landmarks. He confidently asserted that the master and other officers were sober, notwithstanding rumor circulated to the contrary.

Master's Evidence.

The master, Robert Milliken, stated that he left St. John in charge of the aforementioned pilot and remained on the bridge most of the time up to ten or eleven o'clock at night. The weather on leaving was cloudy and overcast and the wind southerly and fresh, but which gradually diminished. The weather became hazy towards the evening, although not to such an extent as to prevent him seeing lights at a good distance. He traced his course from St. John to Brier Island S.W. by S., setting the log. When he passed the Fairway Buoy the log showed 3½ miles. From that time the course steered was S.W. by S.S.W. up to 6.30. When Brier Island was abeam at 6.30 he stated that a four-point bearing was taken, which put him at a distance of nine miles off, the log then showing 61 miles, and there was an index error of 2 miles, gaining for 24 hours. Shortly before 10 p.m. the course was changed to S.S.E., the wind then being E.S.E. At 10-50 the Lurcher Lightship was abeam, two miles off. This distance, he testified, was found by a four-point bearing. The log then marked 95 miles. According to his testimony he withdrew at 11 o'clock to his room or the chart room and never went up on deck of the upper bridge until the time the ship struck, which was at 12.28 a.m. on December 30.

In answer to a question from the court, he said that in plotting his course on the chart there was no allowance for the tide, although the tide at the time he left St. John was ebbing. He came on deck when he heard a rasping or grating noise, and immediately put the ship's engines full speed astern, which operation he repeated several times until four o'clock without any effect. After having reversed the engines, he gave orders to sound the vessel, when he found water was making in No. 3 hold, and later in other parts of the vessel, as she was grinding slightly.

Prior to 11.30, or thereabouts, the Great Yarmouth light was seen by the second mate and apparently reported to the master, but he did not come on deck or on the bridge, nor did he give any instructions to the second mate at the time. After the vessel went ashore he stated that every precaution was taken to try and get the vessel off, an anchor was let go from the bow, but none was put out from the stern. The engines were put full speed astern several times, even when the tide was low, with the intention of getting her head out towards the sea.

Second Officer's Evidence.

The second officer, A. C. Alexander, who was on duty from 8 to 12, stated that at certain times between 10 and 12 the weather became hazy, but objects could be seen two miles distant; that the course steered was S.S.E.; that at 11.20 he saw the Great Yarmouth Light and took the bearing E.S.E., but he saw only one flash on account of the hazy weather. Nevertheless, he kept on at full speed, and, although he claims that the weather was too thick to prevent him from seeing objects at more than 1½ to 2 miles distant, yet no attempt was made on his part to stop the vessel, reduce her speed, or take soundings, or blow the fog whistle. The soundings would have shown that he could not possibly have been where he was supposed to have been if he had consulted the chart.

First Officer's Evidence.

The first officer testified to the fact that he came on deck at 12 o'clock and that the second mate gave him the course as S.S.E., which would bring her a certain distance from Seal Island, and the weather at that time was getting hazy, raining at intervals very heavily, with a light wind from W.N.W. The captain was not on the bridge at the time. He states that the course he steered was the one given by the second mate, and once or twice he had a look at the compass and stated that the ship was going full speed, which would be about 8 to 8½ miles. When the ship struck, a very light shock was experienced, and he noticed that the master came on deck shortly afterwards and rang the telegraph, the ship then being stopped.

Chief Engineer's Evidence.

The chief engineer said that he was in bed at the time of the accident, and the moment he felt the shock he went down to the engine-room and helped to reverse the engines, which was done, and two minutes after the ship was going full speed astern. He then ordered the stokehold and engine-room to be sounded, but no water was making at the time, and he remained in the engine-room until such time as the engine-room began to make water, which was about four o'clock . The ship was bumping slightly at the time and he noticed that the weather was thick.

Second Day's Proceedings.

On the second day of the examination of witnesses, two sailors were examined, and one Henry Morris stated that when the ship left St. John the master and mate were both intoxicated, the mate especially so, as he could hardly stand up. Morris positively swore that both master and mate were under the influence of liquor.

Hoye, another sailor, corroborated the previous witness in every respect, excepting that he stated that after they had discharged the pilot when he approached the master the second time as spokesman of the crew, the master was not in such a bad state as at first, and appeared rational, but refused to entertain the seamen's demand for short-handed pay, owing to loss of one man in St. John. He simply stated that the matter would be settled on the other side.

Another member of the crew was also examined and corroborated the evidence of the previous two, insofar as the fact that the mate was under the influence of liquor, but was not positive as to the master, as he did not see him, being laid up with two frozen fingers.

The pilot, in view of the evidence which was submitted by the sailors bringing accusations of intoxication against the master and mate, was recalled, and he again swore that as far as he could see, the master and mate and other officers were sober and that his orders were executed as he wanted them, and had they not, he would have taken more notice of the situation.

Court Finding.

After carefully reviewing the evidence, the court cannot help condemning the methods followed by both master and second mate as well as those of the mate in navigating their ship.

First of all, the master sails from St. John with an old chart of 1890, upon which very few buoys are marked. Thereupon he sets a course without, as he acknowledged, making due allowance for the influence of tides, but plotted the courses on his charts in a similar manner as if he were navigating a ship in mid ocean. The court admits the evidence having regard to his being on deck off and on until 11 o'clock. The weather at the time did not require his constant presence on the bridge, but according to the log and the evidence submitted up to 12 o'clock the weather was very thick on account of the heavy rain that was falling and therefore it was the ordinary prudence required of a master to be then on the bridge, especially as he was a stranger to the locality and to the Bay of Fundy.

The court cannot accept the courses, or the position he has given, as possible. On the other hand admitting such to be the case, the course laid down to pass Seal Island was absolutely too fine for safety, as in all probability his ship would have brought up on Blonde Rock, instead of stranding where she did, and would have entailed, as well as loss of property, loss of life, undoubtedly.

The court has examined the deviation book and finds that at intervals, observations were made to ascertain the error of the compass; but we do not find any observation had been taken from the time the ship left Jamaica until she got to Halifax and back to St. John. On account of the weather and the overcast sky on the day she left St. John, it was impossible to obtain an observation; but on the whole, it would appear that the compass was very nearly correct, with very little error on most courses, the greatest error being six degrees, which was not on the course that was being steered at the time of the stranding.

As for the second officer, who was on the bridge from 8 to 12, in view of the condition of the weather, the court is of the opinion that from 11 to 12 there was a total disregard of the rules of the road, also of ordinary prudence, which is demanded in navigating a vessel in this particular locality. The weather was then thick, and he admits that objects could not be seen more than two miles distant at 11.20 p.m. If ordinary precautions had been taken, there is not the slightest doubt that the vessel would have got safely out to sea.

Taking into consideration the direction from the Lurcher Lightship to the place where the ship stranded, with her speed and the space of time which elapsed, it is an impossibility for the ship to have fetched into that place in that space of time, that is, following the courses and positions given by the master and second mate. The bearings are given in the log, but there is no mention of cross-bearings or four-point bearings being taken, which leads the court to think that they were only single observations, and guessing as to distances.

With regard to the first officer who came on deck at 12 o'clock, and who was on duty when the ship stranded, if, as he stated, objects could be seen some two miles distant, then a poor lookout must have been kept by himself and the man who was performing that duty, otherwise they would have observed a loom or something akin to it which would have caused some uneasiness in their minds as to the position of the vessel.

There was also a lack of judgment and indifference shown when he came on deck and accepted the second officer's course as leading to Seal Island when, had he plotted the course by the bearing, already taken, he would have found that the course would have brought him on the Blonde Rocks. Again, in view of the condition of the weather, he likewise should have diminished the speed of the ship, and observed the rule of the road with regard to fog signals; it being plainly stated that in misty weather, heavy rain or snow, speed should be reduced and the fog signals sounded.

The court therefore cannot come to any other conclusion than that there has been shown on the part of the master, first and second officers, a considerable negligence in navigating the steamship "Navarra," or otherwise culpable errors of judgment and we agree, in view of the trust placed in these men on this special occasion when the ship was loaded with provisions much needed by the allied armies in France, that it was their duty as Britishers, if loyal, to take exceptional precautions to bring this property safely to its destination.

This is a case in which the court would be justified in using great severity, but in view of the conflicting evidence submitted, it will temper justice with mercy, and for the reasons above enumerated, will suspend the master's certificate of Robert Millikin for ten months; the second officer's, mate's certificate, for six months, and the master's certificate of the chief officer for three months.

without the option in any case of a lower certificate being granted.

"PRINCESS PATRICIA"—"VENTURE" COLLISION.

THE Court of Inquiry, composed of Captain John D. Macpherson, Wreck Commissioner for the Province of British Columbia and Captain W. H. Copp and G. W. Robarts, nautical assessors, constituted to take evidence relative to the recent collision at Vancouver between the C.P.R. steamship Princess Patricia and the Union Steamship Co. s.s. Venture, has made public its finding as follows:

"After carefully weighing the evidence adduced, which, though differing in some details, was, on the whole, clear and convincing, the court cannot come to any other conclusion but that the s.s. Princess Patricia was primarily and solely at fault, and that what little blame can be attached to any person on account of the accident, which accident was, fortunately, slight in itself, but might have had serious results, must be attributed to the master of the Princess Patricia, Joseph Nelson Pitman Ritchie.

"The court is guided to this decision by the fact that the engine-room log book of the Princess Patricia shows beyond all doubt by the entries therein that the ship started from her wharf at 3.04 p.m., went full-speed astern until 3.06 p.m., in other words, until one minute before the collision occurred at 3.07 p.m., and, although her engines were then stopped (3.06 p.m.) ,and half a minute later put full speed ahead, yet the vessel had by that time gathered so much stern way that in spite of her enormous power the collision was inevitable. Again, although going full speed astern, yet she did not indicate that course by three short blasts on her whistle or siren, as required by Art. 28 of the International Rules of the Road.

Certificates Returned.

"The court, though laying what little blame can be attached on account of the accident upon the master of the Princess Patricia, Joseph N. P. Ritchie, is unanimous in its opinion that the occurrence in no way reflects upon his character, skill, or ability as a seaman, inasmuch as the accident was almost inevitable owing to the extremely limited space in which the vessels had to manoeuvre, and the very brief space of time (three minutes) in which the incidents leading up to the accident occurred; and that the Princess Patricia, though a triple screw vessel of large power, has, like most turbine vessels of her class, certain peculiarities which were the reason she had to come astern so far. The court, therefore, unhesitatingly returns to J. N. P. Ritchie, the master of the Princess Patricia, his certificate of competency, feeling that his actions on this occasion in no way call for a reprimand or any reflection on his long and successful career as a master.

"In conclusion, the court is of opinion that no blame can be attached to those in charge of the SS. Venture. The evidence conclusively shows that at the time of the impact she was within a distance of 150 feet from the end of her wharf, and, taking this into consideration, it can but be assumed that not only can she have had but little way on her, but that she was in such a position through her close proximity to her own wharf and to other vessels and wharves nearby, that by the time they realized that the Princess Patricia was backing down on them, it was impossible for them to execute any manoeuvre which would have avoided the accident.

"The court, however, while of the opinion that J. E. Noel, acting master of the s.s. Venture, was justified in assuming that the necessary measures would be taken by the s.s. Princess Patricia, might, nevertheless, have been better advised had he continued 'full speed astern' for longer than he did and waited for the Princess Patricia to make her turn. The court, therefore, returns J. E. Noel's certificate without any further comments."

Annex to Report.

Extracts from the annex to the report show that: "The Princess Patricia left her wharf at Vancouver on the afternoon of December 18, 1914, at 3.04 p.m., in the usual and proper manner by going full speed astern, so as to enable her to make the turn and proceed out of the harbor. She was bound to Nanaimo with 113 passengers on board. Her engine-room log book shows that at 3.06 p.m. she stopped her engines. At 3.06½ p.m. all three engines were ordered 'full speed ahead,' and at 3.07 p.m. she collided with the Venture, striking the latter vessel about amidships.

"At the time of the impact, the Venture was approaching and was within 150 feet of her wharf, and the evidence shows that at that time the Venture had but little way on her. The wharf the Venture was approaching projected more or less at right angles to the wharf the Princess Patricia had just left, and was distant therefrom about 480 yards. The Venture had been to the oil wharf in Burrard Inlet to replenish her oil fuel and was returning to her wharf to load prior to sailing that same night to Northern British Columbia ports, and at the time of the collision she had no passengers on board. The Princess Patricia, in the course of backing down, collided with the Venture. The collision in itself was slight and no very great damage was sustained by either vessel, and taking this fact into consideration, the evidence before the court seems to show that had the Princess Patricia gone full speed ahead with all her engines a few moments before she actually did (say at 3.06 p.m., instead of 3.06½ p.m., as her log book shows), or, better still, had she observed Art. 28 of the International Rules of the Road, by giving three blasts on her siren, those in charge of the Venture would have had their attention drawn to her manoeuvres.

Rules of Precedence Desirable.

"The promulgated by-laws of the Vancouver Harbor Commissioners, covering the circumstances under which these vessels were manoeuvring at the time, distinctly lay down that the International Rules of the Road must be followed. There are no rules as to the precedence of vessels leaving or approaching wharves, and in the opinion of the court, in such busy waters as those of Vancouver Harbor, some such rule would be most desirable. The court is of the opinion that those in charge of both vessels, immediately after the collision, did everything that was possible for the preservation of life and property; that no panic resulted; and that as soon as it was realized that no material damage had resulted, both vessels proceeded to their respective destinations."

S.S. "ASSINIBOIA" STRANDING."

A formal investigation into the causes which led to the stranding of the C.P.R. steamship Assiniboia, on Bad Neighbor Shoal, Georgian Bay, on or about the 2nd day of July, 1914, was held in the Deputation Room, City Hall, Toronto, on the 4th day of February, 1915, before Captain L. A. Demers, F.R.A.S., F.R.S.A., Dominion Wreck Commissioner, assisted by Captain James B. Foote and Captain H. W. La Rush, acting as nautical assessors. Angus MacMurchy, K.C., of Toronto, appeared on behalf of the C.P.R., and John Burnie, K.C., appeared for the master of the S.S. Assiniboia, James McCannell.

Captain's Deposition.

Captain James McCannell deposed that the S.S. Assiniboia is a steel schooner-rigged ship, capable of making 13 knots, drawing 17 ft. 10 in. aft, and 15 ft. 6 in. forward; manned by 85 of a crew, of which two, besides himself, are duly certified deck officers, and three are duly certified engineers. The ship is supplied with the necessary instruments for the efficient navigation of the Great Lakes, having three compasses of Lord Kelvin make, which were adjusted last year; the greatest deviation being 2° westerly. The Assiniboia is an excellent steering vessel.

On July 1st after passing about one mile from the buoy off Detour, he shaped a course and set the log. The course shaped was one always steered in previous voyages, always proving to be correct and invariably bringing his position from 4 to 4½ miles off Great Ducks Islands. In this instance, though the weather was heavy, he obtained a single bearing off Great Ducks Light and estimated he was the usual distance off, and therefore altered his course for Cove Island. In the meantime the weather thickened, but not to such an extent as to cause him to diminish speed, although the whistle was sounded. When his distance had been run, as he thought, to near Cove Island, the ship's speed was diminished to half speed, then slow, and a short while after the vessel grounded, it then being 1.05 a.m. on July 2nd. Up to that time no sound of the fog-horn was heard, the first blast of same being sounded at 1.37 a.m.

He realized his ship was ashore on Bad Neighbor Shoal, about two miles off and abreast of Cove Island. After the grounding, soundings were taken and it was found she was leaking in the forepeak, and efforts were made, with the help of the engines, to extricate the vessel from her position, but to no avail, and it was only after having received help from other vessels that she floated off.

Other witnesses who were members of the crew corroborated the master's evidence.

Lighthouse Keeper's Evidence.

W. J. Simpson, the keeper of the Cove Island light and fog-horn, was examined, and explained the machinery operating the fog horn, and also as to the watches which were kept. He came on watch at one p.m. and remained on duty until six p.m., and his son, his assistant, relieved him on the night preceding the grounding of the Assiniboia about 7 or 8 o'clock, he retiring about 9.30 or 10 o'clock, leaving his son in sole charge. The weather was clear with very light southerly wind, and he had ascertained that the fires were banked up and also noticed that in the reserve tank there was 16 pounds pressure.

At 1 o'clock, or shortly after, on the morning of the 2nd of July, he was awakened by the sound of his son's footsteps on the walk. He then hurriedly dressed and proceeded to the fog-horn, and without loss of time arranged the fires in order to have sufficient pressure to set the horn in operation, and succeeded in getting the first blast at 1.35. He positively stated that he took great care that his son did not go to sleep, as his wife kept watch with him until he came on duty himself.

The rules governing the conduct of lighthouse keepers were read to him with regard to the amount of pressure that should be always in the reserve tank, which is 20 lb. He knew of the regulation, or at least he thought he did, but in this instance had failed to comply with it—Rule 10, page 20 of Rules and Instructions for his guidance. He recollected to have read the whole of the old regulations; but did not think he had studied the new ones very carefully. Rule 4 requires a competent, able-bodied man to be in charge at all times.

Assistant Lightkeeper's Evidence.

The son, who was assistant to the lightkeeper, on being examined, said he was passing his time going into the fog-house and lighthouse, when on watch, seeing everything was all right. He swore that on this evening he did not go to sleep. He corroborated his father's statements that there was 16 pounds of pressure in the air-tank.

About 12.45 that morning he had gone to the lighthouse and after winding the light he saw the weather was getting thick,—it then being 1 o'clock, or 1.05, and as it was quite clear at 12.45 when he went up to wind the light he did not make any preparations towards getting further pressure on the main boiler in the fog-house. He contradicted flatly the statement made by his father that his mother kept watch with him. He said his mother was busy at her work, and on the night of this accident everybody was asleep at 10 o'clock, and he was left alone in charge of the place.

Other Evidence.

Other witnesses were produced by the C.P.R., the owners of the S.S. Assiniboia, who were masters of ships navigating in that vicinity. These stated that there was a current coming in from the Georgian Bay and vice versa according to the winds prevailing. The master of of the Alberta stated that on the day of the grounding whilst making attempts to pass the tow-rope to the Assiniboia he noticed his ship sagged away under the influence of a current which was coming into the bay, and the tow-rope described a curve, showing there was a current then running.

A witness was produced by Mr. Simpson who was supposed to have been on Flower Pot Island at the time of the grounding; but his evidence was of no importance.

It was also stated by masters of vessels giving evidence that at various times it had been noticed that the fog-horn had not been sounded, and one instance in particular was cited, the 5th of May last. The log kept by Mr. Simpson was shown to prove this assertion, the horn not being sounded for some considerable time after the fog set in, and no entry was made in this connection, and Mr. Simpson expressed his surprise that it was omitted.

Finding.

After carefully reviewing the evidence adduced by the various witnesses, we have come to the conclusion that the master of the S.S. Assiniboia adopted every method to navigate his vessel carefully, but owing to a current which he was not aware existed at the time, as they are irregular, it is evident that his vessel drifted from the course he thought he was making. The distance between Cove Island and Bad Neighbor Shoal is about two miles, and it would require very little, on the distance that he had run, to cause him to get to the position of danger.

Whilst we maintain that the fog-horn is a secondary aid to navigation, and the sounds of same cannot be absolutely relied upon owing to the air currents and prevailing winds deflecting the sounds and giving a navigator possibly a wrong impression of his position, it behoves masters of ships to adopt the greatest measures of precaution. In this instance these measures were adopted, and we are going to state that had the fog-horn been sounded it is possible the mishap would not have happened, and we cannot but exonerate the master from all blame with regard to the grounding of his vessel.

The Court has much pleasure in making the statement that it is the first time it has had the opportunity of examining a log so carefully and neatly kept, without erasures or marginal notes.

With regard to the lighthouse keeper, we cannot but state that he has performed his duties in a very perfunctory manner. He has absolutely disregarded the regulations which have been submitted to him with respect to keeping 20 pounds of pressure on the reserve tank in order to be able, in as short a time as possible, to operate the fog-horn, which is absolutely necessary, as the fogs come down very suddenly in that district. Also the fact of placing a boy of 18 years, apparently intelligent, but not realizing the importance of the work he had to perform, is a very grave danger to the safety of shipping at that place, and we may say does not meet with the requirements of Rule 4, which says that at least one competent, able-bodied man must be in charge at all times.

On the whole, we cannot express any other opinion but that there has been negligence; not only on this occasion, but on others which have been proven by witnesses.

CANADA'S ATLANTIC SEABOARD

Shipping and Shipbuilding Enterprises and Industries are Again in the Ascendency in Our Maritime Provinces, and Revival of the Old-Time Activity Appears Imminent

HALIFAX OCEAN TERMINALS.

GENERAL preliminary plans in connection with the new ocean and railway terminals at Halifax have been submitted by the architects, Ross & Macdonald, of Montreal, to the general manager of the Canadian Government Railways. These plans illustrate the general arrangement for the handling of passengers and freight and the facilities provided for the transfer of passengers, baggage, mail and express to and from railway trains and steamships as well as the provision for the handling of local Halifax city traffic.

The general scheme consists of a passenger station building in the shape of a large letter T, the foot of the T being at the shore end, and the head at the steamship landing stage. The shore end of the building provides accommodation for the local Halifax traffic and contains ticket offices, baggage and parcel checking rooms, restaurant and lunch room, women's and men's retiring rooms with toilets, and provision on the upper floors of the building for office space required by the railway and steamship lines.

This portion of the building, which will be known as the Halifax City Station, will face on a plaza located between South and Tobin Streets, the plaza extending from Pleasant Street east to the front of the station building about 400 feet in depth. A place for cabs is provided on the north with access to baggage checking room and to ticket lobby. Passengers on entering the building will find all the facilities they require for transacting their business, after which they may pass on to the train concourse or train waiting room.

The general plan provides a landing stage approximately 2,000 feet long, which is divided into three parts, the northerly third being devoted to the active handling of passengers' baggage, mail and express, the remaining two-thirds being for the handling of cargo. It is upon this northerly end of the landing stage that the top position of the T-shaped building is placed.

Passengers disembarking from steamships will enter the building at the second storey level. Passengers' baggage will be discharged at the same level, and will be distributed in the usual way for customs examination. After baggage has been passed by the customs and then checked by the railway company, it will be transferred to the floor below by means of chutes or elevators to a distributing baggage room from where it will be routed to cars according to destination. Mails will be discharged directly from the steamship to the lower level of the steamship passenger building to a distributing mail room, from where they will be transferred to cars according to destination.

After passengers have landed and passed their baggage through the customs, they will enter into a booking hall containing ticket offices for the railway and steamship lines. Here they may obtain railroad checks for their baggage, secure their tickets and attend to other matters of transportation which they may find necessary. They will then pass into the train concourse or train waiting room, which room connects the steamship station with the Halifax City Station and forms the stem of the letter T.

The train concourse is designed for the common use of the Halifax city traffic and the steamship passenger traffic. The floor of this room is placed on a level with the second storey of the steamship passenger building, and is also level with the ticket lobby floor of the Halifax City Station. The passenger platforms of the train shed are placed at a level between the train concourse and the baggage room beneath.

All stairways have been eliminated between the train concourse level and the passenger platforms, the latter being reached by means of easy inclines. Separate tracking platforms for baggage trucks are provided, and these connect with the baggage room beneath the train concourse by similar inclines, but separate from those of the passengers, thus avoiding all confusion between passengers and baggage.

Large provision is made for the immigration which is expected to come through the port of Halifax, while detention rooms and offices are provided for the various Government officials connected with the immigration work, as well as separate lounge rooms, lunch rooms, sleeping rooms, toilet rooms, etc., for the immigrants themselves. These rooms are not directly connected with the other portions of the station building.

HALIFAX OCEAN TERMINALS AS THEY WILL APPEAR WHEN COMPLETED.

The general arrangements contemplate the erection of a separate power house to furnish light, heat and power for all the buildings connected with the terminal project; a grain elevator for the handling of grain from cars to steamboats, and large track provision for handling freight to and from the pier sheds.

The construction of the sea walls of the landing stage and the first pier has been let and the work is now under construction. The architects are at present preparing plans for all the work in connection with the buildings to be placed upon these piers. The use of local materials is contemplated as far as possible, including granite, sand-stone, brick and concrete.

RECENT DEVELOPMENTS IN MARINE ENGINEERING.

IN the annual report recently issued by Lloyd's Register of Shipping, reference is made to the developments that have taken place during recent years in marine engineering.

Steam Turbines.

A feature worthy of mention in connection with the progress of marine engineering is, the report states, the increasing use of steam turbines. There are at present 23 vessels being built to the society's class in which geared turbines are to be fitted. In addition, there are six vessels under construction in which direct-coupled turbines are to be used, and also six in which the engines will be a combination of reciprocating engines using the steam through the high pressure and first and second intermediate cylinders, but having the low-pressure cylinders replaced by low-pressure turbines.

In this arrangement, which has proved satisfactory in practice, there are three lines of screw shafting, the two outer, port and starboard, being used by reciprocating engines and the centre one by the low-pressure turbine, which takes its supply of steam from both the reciprocating engines. When manœuvring, the reciprocating engines only are used, and they then work independently of the turbine, exhausting directly into the condenser. An advantage of the combination of reciprocating and turbine engines is that the machinery can be worked at reduced power with practically the same efficiency as at full power. The speed of these engines is reduced by "linking up," enabling the full steam pressure to be utilized in the cylinders, whereas, with ordinary steam turbines, the speed can only be regulated by varying the steam pressure, so that when less than full power is required the steam pressure has to be reduced with a corresponding loss of officiency.

Oil Engines.

Reference was made in last year's report to the increasing employment of oil engines for marine purposes. In view of the importance of this means of mechanical propulsion, the committee have now issued rules for the construction and surveying of Diesel engines and their auxiliaries. There are in service at the present time 27 vessels holding the society's classifications which are fitted with Diesel engines, the collective indicated horse-power being approximately 50,000, and 20 others are in course of construction with a view to classification. Of vessels fitted with oil engines of other than Diesel type, there are 36 classed with Lloyd's Register and several others are being built to class.

Oil Fuel.

In last year's report, allusion was made to the recent revision of the society's rules relating to the burning and carrying of oil fuel. These rules provide for the use of oil fuel, the flash point of which is not lower than 150 deg. Fahr. In some cases, however, it has of late been desired to employ oil having a lower flash point, and the committee have approved plans making suitable provisions for the safe use of such oil. The Technical Committee have had under consideration during the year proposed amendments and additions of the society's rules for the construction of ships and machinery.

Wave Bending of Big Ships.—The bending strain of the waves is much less in the great ocean liners than in smaller vessels. In a London Royal Institution lecture, Sir John Lyle pointed out that, when the waves are one-half the length of the ship and one-twentieth of the length in height, the stress is little more than in smooth water; but when the waves are as long as the ship, or one and a half times as long, the effects are much greater. As waves are seldom more than 500 feet long, the bending action on a 900-foot ship. like the "Aquitania," is much less than on a 500-foot ship.

Vessels Re-named.—To obviate any confusion as to nationality, the British steamers Zeeland and Vaderland, operated by the White Star-Dominion Line, have been re-named the Northland and the Southland, respectively, as the Vaderland was frequently taken for the German vessel of that name. This was found prejudicial.

HALIFAX OCEAN TERMINALS AS THEY WILL APPEAR WHEN COMPLETED.

GREAT LAKES AND ST. LAWRENCE

Water Transportation From the Atlantic to the Heart of Canada is one of the Live Issues of our Time and is Daily Becoming of Increased Importance

DRY DOCK EQUIPMENT CONTRACT.

THE general contractors for the Lauzon, Que. Drydock, M. P. and J. T. Davis, have awarded the Canadian General Electric Co. the contract for the apparatus required in the engine room and pump house. It includes three horizontal condensing steam turbo-generators, one of 300 k.w., another of 750 k.w. and a third of 1,500 k.w., with the necessary condensing apparatus, and also a 100 k.w. vertical engine driven direct current generator set.

The main switchboard in the lower house will consist of nine panels, and in the pump house there will be three individual motor panels connected in series with the corresponding panels in the power house, so that the large motors can be controlled at either place. Canadian General Electric Co. apparatus is used throughout. An outstanding feature of the main switchboard is the use of Thompson astatic instruments which are not affected by the heavy stray fields so commonly met with on d.c. switchboards of high ampere capacity. Errors due to such stray fields can only be avoided by using properly shielded instruments which have the fields astatically arranged.

For general drainage purpose there will be two Mather & Platt axial flow centrifugal pumps each of 6,000 Imperial gallons per minute capacity against 40 ft. head and driven by a 125 h.p. motor. For the main dock there will be three Mather & Platt 42-in. axial flow centrifugal pumps, each designed for 63,000 Imperials gallons per minute against a head of 25 feet. Each of these pumps will be driven by a 750 h.p. motor. There will also be a Mather & Platt new type centrifugal pump capable of handling 2,600 U.S. gallons per minute against a head of 25 feet for hot-well purposes, and standard underwriters' steam fire pump of 500 gallons per minute; two outside end-packed boiler feed pumps, a Cochrane feed water heater and other appliances.

TO ENTER ATLANTIC TRADE.

OWING to the fact that prospects are for light carrying business on the Canadian waterways during the coming summer, the Canada Steamship Lines, Ltd., is making arrangements to transfer some of its largest boats to Atlantic routes. The opportunity is an obvious one on account of the tying up of Germany's merchant marine, and also on account of the large number of craft which have been commandeered by the British Government.

It is understood that there are about ten grain carriers of sufficient size to enter the Atlantic trade. There is also a very favorable feature in that ocean rates have increased to a large extent since the opening of the war and there is certain to be a strong demand for Canadian grain.

President Carruthers states: "As the ocean freight rates are quite high, they are very tempting to us. We have many boats capable of carrying ocean-going cargoes of grain and flour and all of these will be used for this purpose as soon as the lakes and canals are sufficiently clear of ice to permit of their being brought to Montreal harbor. We have all the room booked in our boats for May shipment and many more offers for May-June cargoes.

"Our boats will return to the lakes in the fall when the new crop begins to to come down."

NEW C. P. R. ATLANTIC LINERS.

PARTICULARS of the two new vessels recently acquired for the Atlantic service by the Canadian Pacific Railway have just come to hand. These two new steamships, already named Melita and Minnedosa, have a length over all of 520 feet, a beam of 67 feet, and a depth of keel to bridge of 46 feet. They will be fitted with combination turbine and reciprocating engines, driving three screws and giving a sea speed of fifteen knots. The vessels will be of the popular one-cabin type, providing accommodation for over five hundred cabin passengers and 1,506 third-class passengers. A feature of the cabin accommodation is the number of two-berth rooms, there being fifty in all. The public rooms for the cabin passengers will be elaborately decorated and will consist of a large lounge and smoking room situated on the promenade deck, also a gymnasium. The main dining saloon will seat three hundred. Five hundred and fifty can be accommodated in the third-class dining rooms . The Melita and Minnedosa, like their sister ships, the Missanabie and Metagama, will be equipped with Babcock and Wilcox patent davits, which enable lifeboats to be launched from either side, even should the ship have a considerable list. The cruiser stern is also a feature. Every known device for the safety of passengers and crew will be provided, including double-bottom construction, wireless telegraphy and submarine signalling apparatus.

It is expected that the vessels will be ready for service towards the end of the coming season.

SEA-GOING STEEL MOTOR PATROL CRUISER.

By "Naval Architect."

THE chief factor governing the consideration of the accompanying design is the vessel's ability to keep the sea in all weathers and the year round. This involves particular attention to three main features; namely, a strong hull, seaworthy form and comfort, and sufficiency of interior arrangements. The dimensions are determined as the necessary medium for the attainment of this three-fold object, and are as follows:

Length on w. l., 65 feet.
Breadth mld., 12 feet.
Depth mld., 7 feet.
Draft aft, 4 feet.
2 propelling motors, each 30 b.h.p.
Speed, 10 miles per hour.

To satisfy the requirements of strength and seaworthiness, it is proposed that the hull be of steel but to heavier scantlings than usually allowed in the ordinary steel motor cruiser. The spoon bow and cruiser stern are chosen as the strongest form and permit of the simplest construction. The main deck is of chequered steel and turtle backed to instantly free the vessel of water shipped and to best withstand rifle fire.

Sidelights are confined to the superstructure, and the deck lights in turtle deck forward are of the prism variety. All ventilators have steel shutters which can be fixed in place from the underside of deck in bad weather. Only two means of access are provided, and these are by circular steel watertight spring scuttles, which are situated on the casing deck 7 feet above the waterline, and can be quickly shut by a quarter turn of the hand. It is thus evident that weathering qualities are provided to a degree seldom attained in a vessel of such small dimensions.

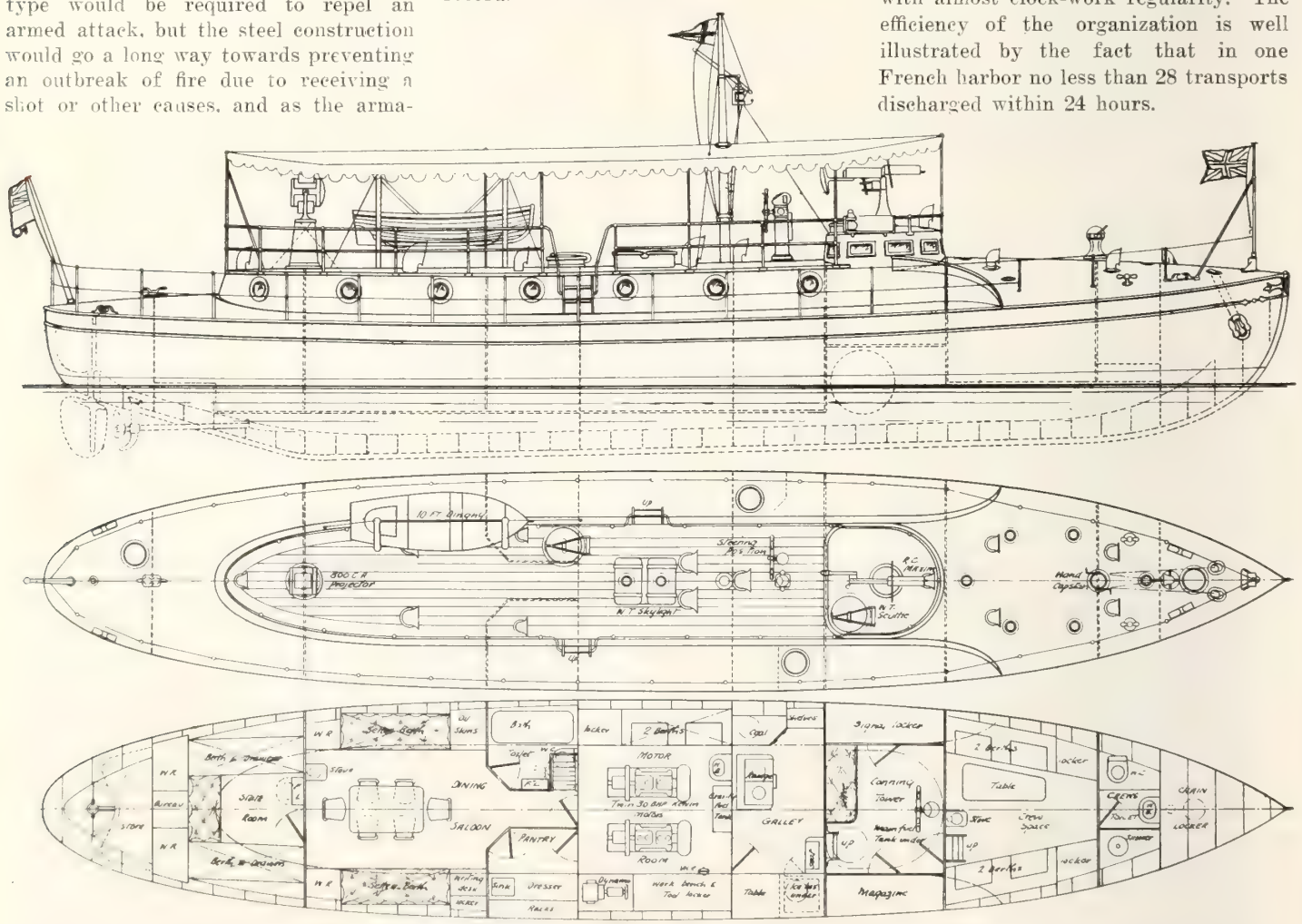
To ensure comfort while cruising in winter, the casing deck is built of 2 in. pine, while the turtle deck and sides of hull are insulated against sweating. The peak bulkheads and bulkheads enclosing motor room are of steel, the former being watertight.

The galley and motor room, two important considerations for continuous

cruising, are commodious and well fitted-up in the central parts of the hull. The propelling agents are twin heavy duty motors of 30 b.h.p., to one of which a reverse gear is fitted, while a dynamo of ample capacity to generate sufficient current to illuminate all accommodation and searchlight projector of 800 c.p. is run off the other. These motors will work on petrol at full capacity on a fuel cost of well under a dollar an hour. Two steering positions are provided, one in conning tower for heavy weather duty and during action when steersman and navigating instruments are well protected, and one on casing deck in fine weather. The accommodation provided, as shown on plan is ample for full working complement and all cabins have generous head room, the height from cabin floor to casing deck being 8 feet. A rifle calibre maxim is mounted on top of conning tower at forward end of casing deck, and a 800 c.p. projector at after end, each having a clear and elevated range. The magazine opens out of the conning tower and ammunition is handed up through a scuttle immediately at rear of gun.

It is not expected that a vessel of this type would be required to repel an armed attack, but the steel construction would go a long way towards preventing an outbreak of fire due to receiving a shot or other causes, and as the armament is merely intended for signalling and purposes of intimidation against unarmed vessels, one maxim as provided is entirely sufficient, though it would be entirely practicable to carry a spar torpedo outfit. A wireless outfit might be of service and could be fitted at any time without detriment to the general layout.

While designed primarily for heavy military duty, this vessel, with minor modifications, will represent in many respects the ideal cruiser for the yachtsman who is averse to being hampered in his arrangements by reason of weather considerations, and who might wish to engage in long over-sea cruises with some degree of comfort and security.



DESIGN FOR OCEAN GOING STEEL MOTOR PATROL CRUISER.
LENGTH OF WATER LINE, 65 FT. BREADTH MOULDED, 12 FT., DEPTH MOULDED, 7 FT. DRAFT, 4 FT. SPEED 9 TO 10 MILES PER HOUR.

Polson Ironworks' 1914 Output.—In our resumé of the world's shipbuilding last month, several items were inadvertently omitted from the 1914 output of the Polson Ironworks, Toronto. The work of the leading Canadian yards was, however, dealt with at greater length in our December, 1914, issue and, to the Polson Ironworks detail statement there, our readers are referred for the official record.

TRANSPORTING BRITISH REINFORCEMENTS.

FRESH British troops, sent as reinforcements to the army of the allies, are being more or less continuously landed in France, and this is done in an altogether admirable way. The great transport ships enter various French ports while the North Sea and the channel are protected by torpedo boats, destroyers, and a few swift cruisers. The transport ships follow each other at short intervals. A calm, cheerful mood prevails on board, when the soldiers enjoy the freedom which is always their privilege in leisure hours.

Hardly, however, has the French coast been sighted than everything is arranged with the utmost speed for the landing. As a ship swings into its place the soldiers stand ready to march. The wagons of the division are ready loaded. Ample space has been reserved on the quays for the landing, but no more are landed than the railways can carry at a time.

As soon as a ship is empty she moves on at once to another point in the harbor, and is followed by a new transport, with almost clock-work regularity. The efficiency of the organization is well illustrated by the fact that in one French harbor no less than 28 transports discharged within 24 hours.

PACIFIC COAST DEVELOPMENTS

Featuring the Record of Progress and Dealing With the Steps Being Taken to Stimulate and Enlarge the Already Established Shipping and Shipbuilding Enterprises

YARROWS, LTD., ACTIVITIES.

JANUARY, 1915, saw much activity at the Esquimalt plant of Yarrows, Ltd. While no new work has been announced, numerous repair contracts were handled by this enterprising firm during the month of January.

The most important repair contract undertaken in the period was the British oil-tank steamer Azov, which sustained extensive damage to her hull when she struck the reefs at Talara Bay. The work carried out on the Azov consisted of bottom damage repairs and also engine-room and deck repairs. About twenty-three new shell plates were fitted, a number of frames and doors renewed or repaired, and twelve new deck plates fitted. The Norwegian barque Wulff was hauled out in the naval drydock for cleaning and painting and, while there, repairs were made to her rudder, damaged when the vessel drove in-shore during a strong gale off the Coburg Peninsula.

Before proceeding to Portland to load grain for Europe, the British steamer Strathdee was placed in dock at Esquimalt for cleaning and painting and rudder repairs. The steamer Princess Sophia, of the C. P. R., had some repairs carried out to rails and stanchions, and minor repairs were also effected aboard that company's steamer Princess Mary. The C. P. R. freighter Otter was hauled out for cleaning and painting.

Other work carried out by Yarrows, Ltd., during the past month, included repairs for the Canadian North Pacific Fisheries Co.; foundry work for the Victoria Chemical Co.; Esquimalt Municipality; Esquimalt Waterworks, etc. The D. G. S. Madge was docked, cleaned and painted, and a new propeller fitted, while repairs were also made to the oil-carrying barge Diamond Head.

"EMPRESS OF INDIA" AS HOSPITAL SHIP.

NO passenger steamer on the Pacific was better known than the Empress of India, of the C. P. R. Pacific fleet, but in the last six months this vessel has suffered so many changes that she would not be recognized by her old friends. When the British Admiralty first requisitioned her, she was painted a dull grey and her fairy-like character was almost lost in the transformation. Then the Maharaja Scindhia of Gwalior and other Indian princes bought her and fitted her as a hospital ship, and as such, with the new name of the "Loyalty," she left Bombay a short time ago, repainted white with long black stripes on the water and deck lines, and with large red crosses amidships.

His Excellency the Governor and Lady Willingdon paid a visit of inspection to the ship shortly before her departure. Deck space which was made for holiday seekers with idle hours is now mostly covered with beds for injured soldiers, just as all the available cabins are serving as private wards for wounded officers. On the main deck of the steamer space has been provided to fill the purpose of wards. Cleared of everything unnecessary, the main deck is well suited for this purpose, for it gives two wide strips of space on each side and gives accommodation for a large number of beds in most pleasant positions on the steamer. Here rows of beds have been fitted and all the requirements of a hospital are installed.

The work of reconstructing the interior of the vessel was put in hand soon after her arrival, and this work completed, the fitting up of the wards, etc., was next undertaken. Between the two wards a small operating room has been constructed and completely equipped. Again, here and there wherever space could be taken, small wards have been arranged, while on the top deck a number of private wards for officers have been prepared. Altogether some 500 beds are available on the vessel.

G.T.P. STEAMSHIP SERVICE.

RESUMPTION of the Grand Trunk Pacific Steamship Co.'s semi-weekly service between Victoria, Seattle, Vancouver and Prince Rupert is being planned. The double-weekly service will be inaugurated about April 1, and before that date the sailing schedules of the coasting steamships Prince George and Prince Rupert will be announced. During the last week in March the steamer Prince Rupert will be brought from Seattle to Esquimault to be drydocked for overhaul and, when she enters the service, the steamer Prince George will be withdrawn for a short period to be cleaned and painted for the summer traffic.

Following the outbreak of war, the G.T.P. ordered the temporary withdrawal of the two vessels from the coastwise trade. The Prince Rupert was sent to Seattle ,where she has swung at a buoy ever since. Just after the Prince George had left Victoria for Prince Rupert at that period, she was detained at Vancouver and ordered back to Esquimalt. She was taken over by the Government to act as a hospital ship, but after making one or two voyages, she was released and was again placed in the Northern trade.

Captain Duncan McKenzie, following the return of the Prince Rupert to the Northern route, will again take command, while Captain D. Donald, who has been acting as first officer of the Prince George, will resume charge of his old ship.

FLOATING DRY DOCK FOUNDERS.

AN attempt to float two cribs destined for the construction of the new Outer Harbor piers resulted on January 30 in the floating drydock, on which the concrete caissons had been built at Royal Bay, Esquimalt, capsizing at her moorings, sinking and carrying the cribs under.

The mishap is believed to have been brought about by the premature flooding of one of the compartments, which caused the vessel to list to starboard. As the drydock heeled over slightly, the weight on the floor of the craft began to slip from its position, the result being it went overboard, wrecking the starboard side of the drydock and at the same time carrying away the overhead traveling crane and the timbered supports. The drydock, it is believed, will be a total loss.

The accident occurred when an attempt was being made to put afloat the first two cribs built for the pier contract. A number of officials and workmen were abroad the drydock just before the accident, but all escaped injury, although two were forced to leap into the water. Small craft were soon on the scene, and the men who had been immersed were picked up and transferred to safety. To those who witnessed the accident it was not apparent that anything serious was wrong until the cribs began to slide. The drydock listed over until the edge appeared to touch bottom, where it held for a few minutes. The two cribs, each weighing 3,500 tons, then began to slip, and as the momentum increased, it was clear an accident was inevitable. The tops of the cribs were afterwards visible above water.

Fifty-four of these cribs have to be constructed for the foundations of the two piers, and the two initial cribs had been under construction for two months

or more. To facilitate the work of construction the floating drydock was shifted from the Inner Harbor to Grant, Smith & McDonnell's new quarry at Royal Bay.

The drydock was chartered from the Seattle Construction & Drydock Co., and several months were occupied in putting it into shape for the work. It had been refloored for the purpose of standing the heavy weights, and strongly timbered supports were erected on either side of the craft to carry the traveling crane overhead. The vessel was declared to be sound in every respect, and nothing appears to have been left undone by the contractors to put her in the best possible shape for the work.

MINES AND MINE-SWEEPERS.

By G. J. W.

ONE frequently sees in the daily press during these troublous times the statement, "Struck a mine—sank in a few minutes," followed by the name of the ship, her value and that of her cargo, and the fate of the passengers and crew. The many such happenings of this nature serve to indicate the important role being enacted by the submarine mine in the present war.

The first appearance of the submarine mine was during the revolution of Britain's American Colonies, when it was described as an "infernal machine of Yankee introduction," outraging all the principles of warfare.

David Bushnell is credited with the conception of the idea and, in order to put the mine to a practical use, designed and constructed one of the first attempts at a submarine boat. The boat was nearly egg-shaped, with room enough to contain a single operator. He propelled the machine by means of treads, which conveyed the foot power to a couple of paddle wheels on the outside. The idea was to approach close enough to an enemy ship usually at anchor, with the minimum possibility of detection. The mine was simply a large keg filled with gunpowder, ignited by a fuse, and so attached to the exterior of the "submarine" as to be easily detached by the operator at the critical moment, the fuse being timed to allow the submarine time to escape the effects of the explosion.

The scheme was certainly clever in conception, but lacked effectiveness at the practical test, as not a single ship was destroyed, and for the time being the mines became a standing joke in the incident known as the "Battle of the kegs," when Bushnell let loose a flotilla of his mines at the British fleet in Philadelphia harbor. The ships were so manoeuvred that their gunners were able to destroy the mines without loss to themselves. The British navy was considerably affected by this invention, and although not a single ship was lost, it can be considered a creditable result that the morale of the fleet was at least upset.

When Bushnell gave up his efforts, Robert Fulton took up the machine, but

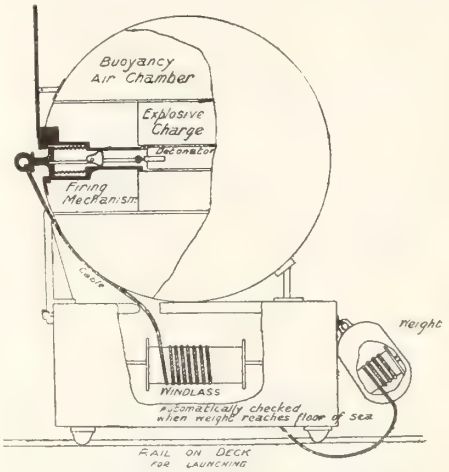


FIG. 1. SECTION OF MINE SHOWING METHOD OF OPERATING.

after spending much time and money in improving it, he was unable to interest France, England and the United States respectively, eventually giving up the mines and torpedoes to turn his attention to the steam engine. Eventually Samuel Colt perfected a scheme to explode fixed mines by electricity, and this brought the mine into use for harbor defence. The British used this mine in blockading Sevastopol during the Crimean war, and in the American Civil War they were used by the South against the Northern gunboats on their rivers.

After this, European nations took up the manufacture and, incidentally, improvement of the mine, thereby making it not only effective but also a legitimate

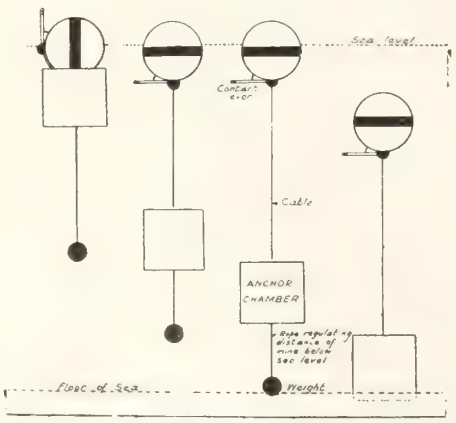


FIG. 2. ARRANGEMENT FOR ANCHORING MINES.

weapon in warfare. It does not, however, seem to have been fully appreciated until the Russo-Japanese War, where its scope was widened from the limits of defensive warfare to offensive work against the enemy in open waters. Considering the smallness of the fleets engaged, the loss of 14 Russian and 10 Japanese warships was enormous, and at the time placed the mine far in advance of torpedo work. Since then, the floating mine on the high seas has been used as a method of offence, but it has the uncertainty of hurting friend and foe alike, becoming immediately a menace to all when once it is sown.

In 1907, before the Hague Convention, the British delegates proposed a rule prohibiting the laying of mines on the high seas, with the exception of permitting belligerents to lay them within a zone of 10 miles from the shore off any naval ports, shipbuilding yards and graving docks, providing due notice was given to neutrals and steps taken to prevent merchant ships being exposed to danger. The proposal was not accepted, and we have seen in the present war what the effect has been.

Most of the mines used are contact mines, and consist of the mine itself, as shown in Fig. 1. A lever is so placed as to explode the charge, while the anchor chamber with attached weight is so arranged as to pay out sufficient cable to maintain the mine at a proper distance below the surface. Fig. 2 shows how a mine adjusts itself after being dropped overboard. The anchor chamber pays out cable, and sinks until the weight reaches the bottom. This checks the cable's unwinding and pulls the mine below the surface.

The only possible defence against mines is countermining and sweeping. The former is carried out by detonating high explosives amongst them and setting them off. The more effective method, however, is removal altogether by "sweeping" operations, which are carried out usually by vessels of light draught. In the present war, steam trawlers and herring drifters have been pressed into use, and have given a good account of their capabilities for the work, although they have by no means been allowed to do so without numerous disasters and loss of life to those on board.

Two vessels proceed through the mine field abreast of each other, say, from 100 yds. to 200 yds. apart, and drag over the mine field a length of heavy chain or wire, which is connected at its ends to the two mine-sweeping vessels. The chain, as it is dragged over the bottom, engages such mines as lie in its path, which are destroyed by contact with each other or by a few well-directed shots from the vessels of the mine-sweeping fleet. The fleet usually consists of six vessels, working in three pairs and under the charge of a commodore. Naturally, operations of this sort can only be carried on in the open seas, or in waters not protected by the fire of shore batteries.—Motor Ship.

EVOLUTION OF THE LIGHT-SHIP.—II.*

By G. C. Cook.

HAVING in our December 1914 issue featured that part of the subject which deals with the lightship from its functional and universality of service viewpoint, and having then discussed the earlier efforts towards its establishment and the original purpose from which these arose, we come, after a long period during which this navigation aid was almost wholly obliterated, to a stage in lightship history when its necessity became sufficiently realized and appreciated, as to mark not only its permanent establishment, but at the same time usher in for it a new era of usefulness, combined with high degree constructional fitness.

Illumination.

In these lighthouses illumination was effected by open fires of wood or coal without reflectors or protection other than iron frames, which were sometimes placed around the fires to prevent dispersion of the fuel. The smoky gleam of these beacon fires was feeble at best, and there was no attempt to reflect it in the proper directions. Often on stormiest nights, when the need of a light was the greatest, none was burning; and there was nothing characteristic in the fires themselves to aid in distinguishing one light from another. In fact, it does not appear that any material improvement was made during the interval from the erection of the Alexandrian Pharos in 300 B.C. to the building of the first Eddystone Lighthouse commenced in 1669.

Passing over the interval, then, we note that apparently the first plan for a sea mark other than these crude lighthouses, was for a floating light off the English coast. Let me quote from W. J. Hardy, who, after making an elaborate study of the question, published in his book, "Lighthouses," the following:—

". . . in 1629 . . . persons petitioned the king for licence to light the Goodwin Sands. . . . After setting forth the dangers of the sands in the usual terms, they state that they are ready, in order to warn vessels of those dangers, to maintain at their own costs 'a light upon the main' at or near the Goodwins, 'whereby every meanly skilful mariner' could, on the darkest night, safely pass the place of danger. . . . 'Upon the main' must here mean the main or open sea, especially as the words 'at or near the Goodwins' immediately follow: that expression cannot refer to the mainland, eight miles off at its nearest point, for lights at the two Forelands were then already established, and the expression 'on the main' would not have been used if a tower built on the sand had been intended. There is, I think, but one way of interpreting this . . . that is, . . . for a floating light or lightship at the Goodwins."

It is, therefore, fair to say that the first positive sea mark contemplated by the English was the lightship, although the first Eddystone Lighthouse was finished in 1700, thirty years before the project which ultimately established the lightship was put forward.

Introduction of the Lightship.

By 1730 the work of lighting the coasts of England had been, to a great extent, assumed by the well-known Trinity House Corporation. The introduction of the lightship, however, is due to two men, Robert Hamblin and David Avery, who were regarded by that body as mere adventurers. Hamblin obtained a patent from the Crown in 1730 permitting him to establish lightships along the coast. Unwisely, he proclaimed his intention of displacing all other sea marks with lightships, and the Trinity House looked upon his efforts as an infringement of its privileges and opposed them with all means at its command.

The result was a general cancellation of the Hamblin patent, with exception of the rights to a few stations which he had already sold to Avery. By a little diplomacy Avery obtained the goodwill and co-operation of Trinity House, and in 1732, at the east end of the Nore Sands in the estuary of the Thames, established the first modern lightship.

The characteristics of this vessel were those of a small fishing sloop. Two small lanterns, burning oil with flat wicks, were carried at the extremities of a yard. The light was dim at its best, and the lanterns were so defective that the flame was frequently blown out in stormy weather. Then, too, the violent pitch and roll of the vessel often snapped the lanterns bodily from their lashings, and the vessel itself chafed its hempen moorings and broke them again and again.

In spite of these defects the first lightship proved itself indispensable. A similar vessel was stationed on the Dudgeon Shoal in 1736, and its lanterns were especially arranged to distinguish it from the Nore. Thus it appears that the now general use of characteristic lights for all beacons originated on board the lightship.

Lightship Improvements.

The breaking of moorings and loss of lanterns, so common with these early ships, led to the first improvements. These consisted in the use of heavier anchors attached by chain cable in lieu of hemp, and in the construction of a lantern which fitted bodily about the mast. Robert Stevenson, in his "Account of the Bell Rock Lighthouse," speaks of this type of lantern as an innovation on his Bell Rock Lightship, stationed off the eastern coast of Scotland in 1807. There is, however, in the Trinity House Museum, London, a model representing a lightship built in 1790, which is fitted with lanterns of this kind. It may therefore be that either Mr. Stevenson was in error or that this model represents the vessel not as built, but as it appeared after being fitted with the lantern invented by him.

Disregarding these improvements entirely, however, we find that the lightship represented by the Nore and Dudgeon was firmly established as an indispensable aid to navigation. In 1790 the Newarp Shoal Lightship, presumably that referred to above, was stationed off Yarmouth, and in 1795 the famous Goodwin Sands off the south-east coast of England were marked for the first time, as they have been ever since, by lightship.

The question whether or not Robert Stevenson, the first of the distinguished Scottish family to devote his genius to the lighthouse service, introduced the mast-encircling lantern, is of little moment in view of the improvements which he added to it on the Bell Rock Lightship. His record of this vessel is also the most ample of any concerning these early lightships, and the paragraphs necessary for its history are well warranted.

In 1806 the British Parliament empowered the Commissioners of Northern Lighthouses in Scotland to construct a lighthouse on the Bell Rock, a dangerous sunken reef to the north of the entrance to the Firth of Forth. The Act also authorized the collection of dues for lights immediately upon the location of a successful signal at the Rock.

*From a paper read before the Society of Naval Architects and Marine Engineers, New York.

DOMINION SHIPBUILDING, ENGINEERING & DRYDOCK CO.

THE Dominion Shipbuilding, Engineering & Drydock Co., Vancouver, B.C., advise us that the clearing of the plant site has been completed, and the foundations finished for the six shops as outlined in their prospectus. These consist of machine shop, boiler shop, forge shop, foundry pattern shop, stores and general offices. Each of these buildings is 250 ft. long by 68 ft. 6 in. in width.

The contract for the dredging of the fresh water canal at the mouth of Lynn Creek, and also for the construction of the 4,000 ton and 1,000 ton marine railways have been awarded to the B.C. Granitoid Co., and the dredges are now at work. By the late spring, it is expected that the first unit of the plant comprising the above shops, together with the two marine railways and the fresh water canal, will be in operation.

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SHIPBUILDING BOOM SPREADING.

IN a recent issue we referred editorially to the shipbuilding boom as touching British yards, and pointed out that but for the lack of enterprise on the part of our prominent business men and the callousness of successive administrations towards the propagation of shipbuilding and marine engineering on our ocean coasts and highways, we too would have been participants to our pleasure and profit.

Advices now to hand from the United States indicate that there too a shipbuilding boom has not only developed but is growing in intensity, more particularly of course as far as ocean coast and ocean waterway plants are concerned, but it is worthy of note even in this connection, that the authoritative statement is made that such conditions as are now in evidence affect favorably every State in the Union. In less than two months practically all of the United States coast yards have been gradually filling up with orders, a circumstance which goes to show that the demand for both ocean and coastwise craft is in no way locational, either continental or national. American lake shipyards are not of course sharing in the revival any more than are those of our own, the work of both being largely confined to repairs and overhauling for the ensuing navigation season.

Canadian and American lake shipping, together with conveniently located shipbuilding and marine engineering plants are economic necessities, but the scope of the combination enterprise is quite limited, and can never begin to measure up to either normal demand or development possibility of overseas requirement. It is said that at no time in the last twenty years have Atlantic coast American shipyards had so much work on hand, and the same could have been said of Canada's ocean coasts and ocean waterways had there been less of the personal and more of the patriotic in our general make-up.

In this issue a fairly comprehensive description of the well-nigh completed shipbuilding and marine engineering plant of the Canadian Vickers, Ltd., appears, and we take a pardonable pride that to-day it is in a position to produce either for commercial or war purposes. More institutions of its nature are a requirement, if we would develop broadly and deeply, and strengthen our industrial foundations, and to bring this about something more than mere enterprise promotions are required. The capital outlay for almost any class of shipbuilding and marine engineering plant runs to a substantial amount and rarely if ever gives promise of quick investment returns, a circumstance that perhaps more than anything else has weighed with Canadian capitalists who had considered embarking in such an enterprise. However all of this may be, what we cannot or will not do for ourselves the stranger will, and so far as the common good or the greater development of our country are concerned, the results will be equally, if not more satisfactory than otherwise.

C.P.R. vs. STORSTAD OWNERS' SUIT.

THE three million dollar suit of the C.P.R. against the owners of the Norwegian collier Storstad, arising out of the collision off Father Point between the Empress of Ireland and that vessel on May 29 last, opened at Montreal on February 15, before Mr. Justice Dunlop, sitting in Admiralty Court. The hearing of evidence is still in progress as we go to press, on which account we have made no report in this issue. We hope, however, to publish a more or less comprehensive statement of the proceedings in our March number, by which time the judge's finding will doubtless also be available.

Marine News From Every Source

The John S. Metcalf Co., of Montreal, is now completing elevator No. 2, for the Manchester Ship Canal Co., at a cost of $900,000.

Collingwood, Ont.—Equipment for operating the machine shop of the Collingwood Shipbuilding Co. by hydro-electric power has been recently installed.

Collingwood, Ont.—The Collingwood Shipbuilding Co. have received a contract to instal new engines and boilers and renew the cabin accommodation of the steamship City of Midland.

Yarrows, Ltd.—The business of the British Columbia Foundry & Engineering Works Co. has been taken over by Yarrows, Ltd., as from July, 1914, and is now being operated as part and parcel of the latter concern.

Trans-Pacific Service.—The Canadian Pacific Railway steamships will resume their trans-Pacific service early in March with the sailing of the Mounteagle, which has been released by the Admiralty. The vessel will sail from Vancouver.

S.S. "Metagama" Maiden Voyage.—It is expected that the Canadian Pacific steamer Metagama, the sister ship of the Missanabie, will make her maiden trip late in March as scheduled, notwithstanding the present conditions arising out of the war.

Ottawa, Ont.—The Quebec Harbor Commissioners were here recently asking that in the estimates for the coming session sufficient appropriations be made to permit of the harbor works being finished. The amount required is about a million and a half dollars.

Shrapnel Shell Order.—The Collingwood Shipbuilding Co. have received their first order of shrapnel shells from the Canadian Government, and although the quantity is not named we understand it to be large and the forerunner of further orders. Production will be started immediately, the necessary machinery purchased has been installed.

Sidney, C.B.—A Government engineer has been at Flat Point for several days past assembling and putting into place a new fog alarm system at that important section of the harbor entrance. It is the intention to install a much more powerful apparatus than that heretofore in use.

Point Hawkesbury, C.B.—H. W. Embree & Son have secured the contracts to build two patrol steamers for the Government. They will be about fifty feet in length and up-to-date in every respect, costing about $6,000 each.

Shipbuilding in Spain.—The Times says that a Spanish naval construction company, in which British capital is invested, is erecting at Bilbao, Spain, shipbuilding yards for the construction of merchant vessels. Among the first to be built will be twenty liners for a trans-Atlantic company.

Montreal, Que.—A plan to make the St. Lawrence river navigable the year around has just been proposed by M. J. Butler, the retiring president of the Canadian Society of Civil Engineers. Mr. Butler plans to eliminate ice jams by means of dams and locks and keep navigation open with ice breakers.

Toronto, Ont.—The Toronto Board of Harbor Commissioners estimate that $2,100,000 will be spent on harbor work this year. The work will go right ahead, as the commission has now all the money needed. It recently raised $1,000,000, and had a $500,000 balance from last year. The work will be divided between the Government and the Commission.

St. John's, Nfld.—The steel steamer Lintrose, built for the Reid Newfoundland Co. in 1913, has been purchased by the Russian Government for service as an ice breaker in the White Sea. The vessel will replace the Canadian Government icebreaker Earl Grey, which proved inadequate to cope with the severe conditions and is now frozen in at Archangel.

The American Shipbuilding Co. has placed a contract with the Great Lakes Dredge & Dry Dock Co. for the construction of a new dry dock 700 ft. long and 102 ft. wide at its South Chicago yard. Work will be started at once, it being planned to have the dock completed by September 15. The present dock at South Chicago is 564 ft. long and 70 ft. wide.

War Service Badges.—The badges for war service promised by the Imperial Government to those engaged in the construction of war vessels and the manufacture of armaments have been presented to the men in most of the Clyde shipyards and engineering shops. The badge has a gold centre, with embossed crown, surrounded by a border of dark blue enamel bearing the inscription "On War Service, 1914."

Well Deserved Recognition.—Vice-Admiral Sir David Beatty, in his report on the recent North Sea fight, declared that credit was due to the engine and boiler-room staffs for the fine steaming of his squadron during the engagement. These, naked, blackened, shut off from hope of escape if a grave mishap happens, are rarely heard of in the accounts of the battles they help to win. There are none on the ships, however, who have greater call for quiet courage or on whom the toil of the day falls more heavily. It is well when some one whose voice rings clear and commands attention declares their worth.

John S. Metcalf Co., Ltd., of Montreal, is designing two elevators for the Arthur Guinness Son & Co., the famous Dublin brewers. The two elevators are for their new plant at Manchester, England. One of them will have a capacity of 835,000 bushels, and will receive, store and clean barley. The second elevator will have a capacity of 600,000 bushels, and will be used exclusively for malt. There will be in addition facilities for handling both sack and bulk grain from boats and from cars. Both structures will be of concrete. The cost of the work is approximately $600,000.

New Westminster, B.C.—The steel tug "Queen," built by the Westminster Marine Railway for Greer & Coyle, of Vancouver, B.C., was launched from the builders' shipyard on Lulu Island on Jan. 19, and towed to the wharf of the Vulcan Ironworks for the installation of oil tanks. The Queen is an oil burner, and will be used by the owners in the

log-towing business mainly. She is 87 feet long, 20 feet beam and has a maximum draught of ten feet. A big party, including many visitors from Vancouver, witnessed the launching of the vessel, which was the occasion of considerable enthusiasm among those concerned. It is about six months since the new vessel was laid down.

Welland, Ont.—The contract for No. 8 section of the Welland Ship Canal at Humberstone, will probably not be let until late in the year. As only $5,500,000 has been appropriated for the canal, the greater part of this will be expended on those sections already under construction.

Sarnia, Ont.—Outfitting for the coming season is now beginning on the many vessels lying in winter quarters here, and this is always taken as a sure sign that the winter is getting about over. Numerous repairs are being made to the barges and steamers owned by Capt. Horne, while the Imperial boats, and the Northern Navigation fleet are coming in for a good many repairs and alterations.

Lakes and River Rates Committee.—The meeting of the Great Lakes and St. Lawrence River Rate Committee, which is made up of the principal steamboat companies of the United States and Canada, operating on the Great Lakes and St. Lawrence River, was held at the King Edward Hotel, Toronto, on Jan. 28. No radical changes in rates were made. Buffalo was selected as the next place of meeting. John F. Pierce, general passenger agent of the Canada Steamship Lines, Ltd., was elected to the chairmanship, and Jas. Morrison, assistant general passenger agent of the C. N. R., was elected secretary for the ensuing year.

German Battleship Construction. — There are three or four German battleships under construction. They include the Kronprinz, which is nearing completion at Krupp's yard at Kiel. She is the fourth of her class being fitted with ten 12 in. 50-calibre guns. The designed speed is 22 knots, and the displacement 26,000 tons. She is to be propelled by three turbines of the Parsons type, each developing about 11,000 h.p. The other craft are of the 1913 program, which comprise three 29,000 ton vessels, armed with eight 15-in. guns, and designed for a speed of 23 knots. One of these boats may have been modified in design, and none of them can be completed till 1916, or late in 1915, at the very earliest. In the meantime many British battleships and cruisers are fitted with 15-in. guns, several already being in commission.

Fire Aboard "Rapids King."—Early on Friday morning, Feb. 12, fire broke out on the steamer "Rapids King," which is wintering at the Canada Steamship Lines dock, at the foot of Bay St., Toronto. By the time the blaze was extinguished the damage done to the vessel had reached the neighborhood of $5,000, while the steamer "City of Ottawa" was also slightly scorched. The blaze, which was discovered by the watchman, started on the cabin deck in the stern of the vessel, and when the firemen arrived the flames were threatening to clean up the whole deck. With two streams the firemen promptly had the blaze under control, but not before considerable damage had been done to the interior of the vessel's cabin. To the "City of Ottawa," moored close by, damage to the extent of $100 was done.

Stolen Plans.—The "Matin" (Paris) says the German submarines now being used against British merchant ships are made after plans by the American designer, Simon Lake, of Bridgeport, and which were stolen from him by Krupp's. The plans were submitted to Krupp's, whose directors gave their word of honor to divulge nothing. Eventually they entered into engagements on behalf of the Emperor whereby the designer was to receive $3,000,000. As he could get neither his money nor his plans back, he expostulated, and was told that the patenting of anything concerning war was illegal in Germany, and that he, therefore, had no claim. Mr. Lake has since seen several German submarines, and is convinced they are built from plans be confided to Krupp's.

STATUS OF NAVAL ENGINEERS.

THE decision of the Admiralty to grant military rank to the engineer officers of the old system of entry comes at a particularly appropriate time, first as a recognition of the value of their contribution to the success of all naval operations; and, secondly, of their desire for the maintenance of the best traditions of the engineering service under the new lieutenants. It comes, moreover, at an appropriate time, because recent naval actions have shown beyond any possibility of doubt that speed is the dominant factor in success.

As one of the highest in authority in the Navy, and ablest to judge, has said: "The unapproached efficiency of our engineers in the Navy merited this tardy recognition of their all-important work in the splendid fighting condition of our whole fleet, and this has been combined with an unswerving loyalty to a changed system, which they one and all recognize to be for the public benefit and for the good of the Navy. Machinery has no nerves, the all-oil boilers do not get tired, and the unfailing propellers get us, at top speed, on the spot to a minute, though 7,000 miles away."

Engineer officers will now wear uniforms exactly similar to those of the officers of corresponding rank in the existing military branch. The distinctive color between the lace on the sleeves will be retained. They will retain their present titles. There will, however, be no change in their status as regards the command of His Majesty's ships, they will be subject to the authority of any officer who may be in charge of the executive duties of the ship, or acting as officer of the watch, or specially detailed for the charge of any other special service or duty, or whatever seniority such officer may be. Otherwise the authority of such engineer officer in the work of his department will continue to be ranked as at present. This latter clause probably meets the case, especially when, as is so often the case, the officer in charge of the executive duties of the ship acts tactfully.

$2,500 FOR SINKING GERMAN SUBMARINES.

TO the captain, officers and crew of the first British merchant vessel (other than an armed cruiser) which succeeds in sinking a German submarine, Syren and Shipping, the well-known British shipping journal, will present the sum of $2,500, the money to be distributed amongst the various recipients according to their ratings. We mean, of course, any vessel which does not carry guns supplied by the Government. The captain who is enterprising enough to provide himself with weapons out of his own resources will be quite eligible for the award. The money should soon be earned.

At first glance, perhaps, the idea of a merchantman deliberately attacking a war vessel may seem rather bold, but it must be remembered that the submarine is the most vulnerable craft afloat, and that she carries on her operations under conditions of great difficulty. It should therefore be easy to devise some method of attacking her, and of attacking her, moreover, with every chance of success. It is not within our province to offer suggestions as to how, or by what means, the attack should be delivered. In the first place such a course would probably defeat its own ends by warning the enemy of what he might expect; while, secondly, a practical and experienced seaman will, without doubt, be better able than a landsman to devise an efficacious plan of campaign. We cannot say that the vessel which attempts to earn our award will run no danger herself, but it can at least be said that the danger is far less than it seems to be.

Admiral W. H. Henderson has explain-

ed how easy it is for a merchant ship to escape from a submarine, even if the latter have the superior speed, and it is always the case that a foe who can be easily dodged is himself very susceptible to attack. What the Admiral says with regard to small vessels of low speed is that the submarine "may be avoided by turning eight points or more continuously as she approaches, on the principle of a punt hunt." It requires no very great effort of imagination to see that if this operation can be so effectively performed—and Admiral Henderson's reputation is quite sufficient guarantee that he is not talking at random—it may at any moment become possible to convert it from a defensive into an offensive one, or, in other words, that the attacked may become the attacker.

Courage and resourcefulness will, of course, be needed, but those qualities, fortunately, are the rule rather than the exception amongst the men who command our merchant ships. The whole life training of those men has tended to make them quick and ready, able to form a decision instantly, and to act upon it as rapidly, and that is precisely what is required in this instance. A short flight conducted on the lines indicated by Admiral Henderson; a sudden turn upon the pursuer at the psychological moment; and the deed would be done.

The submarine, no doubt, would use her gun—if she possessed one, which is not invariably the case—but, as the admiral points out, her weapons would be small, and her shooting probably very inaccurate. Moreover, the merchantman herself might have rifles on board—these it will be seen, are not a disqualification for the earning of our award—and she might use them with such effect as to force the pursuer to confine herself to her proper weapon—the torpedo. However, we need not go farther into this side of the case.

That a certain amount of danger would attach to the attempt to rid the seas of one of these pests is a fact which is not to be ignored, but we do not think that it would count for very much with any British seaman. Indeed, we even doubt whether such a prize as that which we are offering is really necessary in order to spur our mariners on to the attempt. The money is being offered rather in the nature of a reward for work which is certain to be done than as an inducement to anyone to essay it.

BIG GUNS.

THE early stages of the military campaign in Europe demonstrated conclusively that the big gun was to play an important part in the contest for supremacy on land; and the minor conflicts at sea have shown that the same principle holds good there.

It is a noteworthy fact that the Germans did not pay particular attention to the development of guns of very large calibre for naval purposes, until just previous to the commencemnet of the war. Apparently they were quite satisfied with their 11 and 12-inch weapons, but in 1913 their ideas underwent a big change, and the vessels laid down in that year were to be fitted with 15-inch weapons, so that by 1918 Germany would have possessed a full division of ships armed with the new weapon. This gun was only produced by Krupp's after a series of failures, and after insistent demands by the big-gun school.

The heavy gun has proved its superiority, says the Liverpool Journal of Commerce, but Germany now finds herself in a position of hopeless inferiority from the ordnance point of view. Against Britain's 12-inch, 13.5-inch and 15-inch weapons the enemy can only reply with a large number of 11-inch and a few 12-inch guns. Size of gun is, however, not the only factor, for the method of manufacture is altogether different in the two countries.

The German gun is made by shrinking a number of cylindrical layers on top of each other, while the British guns are known as wire wound, that is, a number of the layers are replaced by winding on miles of wire. The Germans have held to their special type, because they considered that our weapons lacked longitudinal strength. This, however, is one of the many points which this war should definitely settle.

LLOYDS' QUARTERLY SHIPBUILDING RETURNS.

THE recently issued shipbuilding returns compiled by Lloyd's Registry of Shipping for the quarter ending Dec. 31, 1914, show there were 462 merchant vessels of 1,627,316 gross tonnage under construction in the United Kingdom at that date. Warships building are for obvious reasons omitted from the report.

The tonnage now under construction in the United Kingdom is about 96,000 tons less than that in hand at the end of last quarter, and about 329,000 tons less than the total building 12 months ago. Of the vessels under construction in the United Kingdom at the end of September, 383 of 1,220,091 tons were under the inspection of the surveyors of Lloyd's Register with a view to its classification.

Size of Vessels.

The following table shows the vessels under construction in the United Kingdom classified according to gross tonnage, and all steam:—

Gross Tons.				No.
*100	and under	500	tons....	138
500	"	1,000	"	27
1,000	"	2,000	"	46
2,000	"	3,000	"	34
3,000	"	4,000	"	49
4,000	"	5,000	"	43
5,000	"	6,000	"	31
6,000	"	8,000	"	31
8,000	"	10,000	"	26
10,000	"	12,000	"	7
12,000	"	15,000	"	—
15,000	"	20,000	"	10
20,000	"	25,000	"	2
25,000	"	30,000	"	1
30,000	"	40,000	"	1
40,000 tons and above.....				1
Total				453

*Vessels of less than 100 tons are not included in Lloyd's Register Shipbuilding Returns.

Catalogues

Marine Engines.—Catalogue No. 11, issued by the Gas Engine & Power Co., and Charles L. Seabury & Co., Consolidated, New York City, describes the Seabury marine engines for commercial and pleasure craft. A description covering the design of this type of engine is given accompanied by a number of illustrations. A list of the various sizes is included giving the principal dimensions for various horse powers.

Generating Sets.—The Canadian General Electric Co., Toronto, has issued Bulletin No. 42,300, dealing with steam-engine driven generating sets designed originally for marine work, but also well adapted for isolated plant service. Full particulars are given covering the design and construction of these sets, both simple and compound, while the illustrations show the details. The generator is also described at length and tables are also described at length and tables are included giving the principal dimensions for the various sizes of each type.

Centrifugal Pumps is the title of a 64-page bulletin just issued by the Terry Steam Turbine Co., Hartford, Conn., giving details and data on various turbo-pump applications. The principles of operation and construction of the centrifugal pump are clearly explained, as are the details of the steam turbines which have been successfully used during the past ten years for driving them. This booklet should be in the hands of those who are interested in any kind of a pumping problem. Copies may be obtained on application.

ASSOCIATION AND PERSONAL

A Monthly Record of Current Association News and of Individuals Who Have Been More or Less Prominent in Marine Circles

John Fleetwood, well known in shipping circles at Montreal, has retired from the position of passenger manager of the White Star-Dominion Line at Liverpool.

Capt. James R. Innes, ex-commodore of the Michigan Central car ferry fleet, died at Walkerville, Ont., on January 25. Captain Innes was born in Chatham, Ont., 73 years ago.

Dominion Marine Association.—A. E. Mathews, Toronto, head of the Mathews Steamship Co., was elected president at the annual meeting of the Dominion Marine Association, held in Ottawa on February 16. The other officers are:—First vice-president, H. W. Richardson, Kingston; second vice-president, W. E. Burke, Montreal, of the Canada Steamship Lines; general counsel, Francis King, Kingston; executive committee, W. L. Reed, Toronto, of the Canada Lake and Ocean Navigation Co., and Denis Murphy, Ottawa, of the Ottawa Transportation Co.

E. J. Trist, a well-known expert designer of marine craft, passed away suddenly on February 10. He had been resident in Vancouver for the last ten years, and among the vessels which he designed and superintended are the North Vancouver Ferries Nos. 2 and 3; the Anglican Coast Mission boat, Columbia; Mr. De Grey's Yacht, Faloma, etc. Mr. Trist was born in Dartmouth, Devonshire, England, in 1849, and has always followed the shipbuilding business. Coming to Canada in 1884, he settled in Toronto. A few years later he moved to Owen Sound, where he was superintendent for the Polson Iron Works, and took charge of the construction of the C.P.R. steamship Manitoba, the first large vessel of the Company's Great Lakes fleet. Since coming to Vancouver Mr. Trist had worked in connection with the Wallace Shipyards, and privately. For the last two years he has been in ill-health, but his death was both sudden and unexpected.

LICENSED PILOTS.

ST. LAWRENCE RIVER.

Captain Walter Collins, 43 Main Street, Kingston, Ont.; Captain M. McDonald, River Hotel, Kingston, Ont.; Captain Charles J. Martin, 13 Balaclava Street, Kingston, Ont.; Captain T. J. Murphy, 11 William Street, Kingston, Ont.

ST. LAWRENCE RIVER, BAY OF QUINTE, AND MURRAY CANAL.

Captain James Murray, 106 Clergy Street, Kingston, Ont.; Capt. James H. Martin, 259 Johnston Street, Kingston, Ont.; John Corkery, 17 Rideau Street, Kingston, Ont.; Captain Daniel H. Mills, 272 University Avenue, Kingston, Ont.

ASSOCIATIONS

DOMINION MARINE ASSOCIATION.

President—A. E. Mathews, Toronto. **Counsel**—F. King, Kingston, Ont.

GREAT LAKES AND ST. LAWRENCE RIVER RATE COMMITTEE.

Chairman—W. F. Herman, Cleveland, Ohio. Secretary—Jas. Morrison, Montreal.

INTERNATIONAL WATER LINES PASSENGER ASSOCIATION.

President—O. H. Taylor, New York.

Secretary—M. R. Nelson, 1184 Broadway, New York.

THE SHIPPING FEDERATION OF CANADA

President—Andrew A. Allan, Montreal; **Manager and Secretary**—T. Robb, 218 Board of Trade, Montreal; **Treasurer**, J. R. Binning, Montreal.

GRAND COUNCIL, N.A.M.E. OFFICERS.

L. B. Cronk, Windsor, Ont., Grand President.
A. F. Hamelin, Montreal, Que., Grand Vice-President.
Neil J. Morrison, P. O. Box 238, St. John, N.B., Grand Secretary-Treasurer.
E. Read, Vancouver, B.C., Grand Conductor.
A. J. Ross, Halifax, N.S., Grand Doorkeeper.
James Gillie and A. E. Kennedy, Kingston, Ont., Grand Auditors.

SUBORDINATE COUNCIL ELECTIONS, N. A. M. E.

ELECTIONS of officers of subordinate councils, National Association of Marine Engineers took place recently as follows:

Kingston, No. 4. — President, E. Spence; 1st vice-president, W. McWilliams; 2nd vice-president, Joseph Kennedy; secretary, James Gillie; treasurer, J. F. McEwen; conductor, W. Dunnigan; doorkeeper, John Kennedy; auditors, T. J. Bishop and John Kennedy.

Toronto, No. 1.—President, C. Arnott; 1st vice-president, A. McLaren; 2nd vice-president, J. Bonner; secretary, J. S. Adams, 631 Gladstons Ave.; ass't sec., J. Henry; treasurer, S. Gillespie; conductor, H. Macdonald; door-keeper, A. Baxter; auditors, Messrs. Byers and McGowan.

Halifax, No. 13.—President, Robert Blair; 1st vice-president, M. J. Doyle; 2nd vice-president, W. A. Case; sec'y-treas., C. A. Pearce; doorkeeper, L. B. Church; audit committee, J. G. Clark and S. J .Hill.

Midland, No. 12.—President, George Wilson; 1st vice-president, Harry McElroy; 2nd vice-president, George Smtih; secretary, Roy N. Smith; asst. secretary, George McDonald; treasurer, J. B. Hanley; conductor, Edward Root; doorkeeper, William Keith; auditors, A. Black and Edward House.

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Victoria,	6	John E. Jeffcott,	Esquimault,	Peter Gordon,	808 Blanchard St., Victoria, B.C.
Vancouver,	7	Andrew T. Roy,	3812 18th Ave., W.,	E. Read.	Room 8, Jones Bldg., Vancouver, B.C.
Levis,	8	Michael Latulippe,	Lauzon,	S. G. Guenard,	Bienville, Levis, P.Q.
Sorel,	9	John Matte.	Sorel,	Al. Charbonneau,	P. O. Box 132, Sorel, P.Qa.
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Midland,	12	George Wilson	Midland,	Roy N. Smith	
Halifax,	13	Robt. Blair,	29 Preston Street,	Chas. E. Pearce,	Portland St., Dartmouth, N.S.
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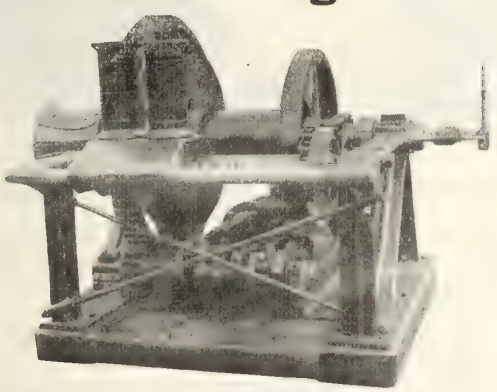

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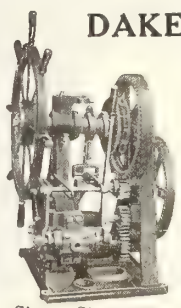

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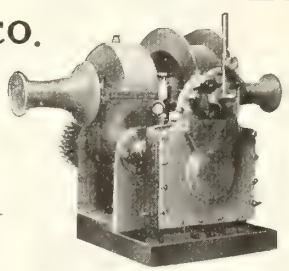

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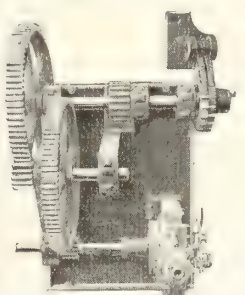

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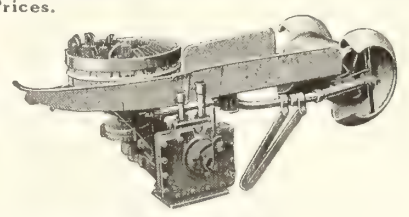

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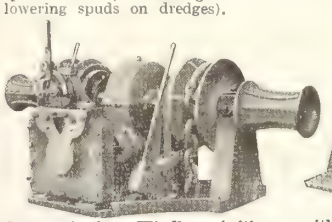

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U.S. MERCHANT SHIPBUILDING.

UNITED STATES merchant ship construction during the calendar year 1914 aggregated, says a correspondent of the Iron Age, 1,163 vessels with a total of 255,630 gross tons, as compared with 1,501 vessels with a total of 382,569 gross tons in the calendar year 1913, according to statistics which have just been compiled by the Commissioner of Navigation. This decrease of 338 vessels, of 127,029 gross tons, is attributed to the general depression prevailing throughout all industries during the year just ended and which was participated in by the ship yards of the country to more than the average extent because of the uncertain future of both foreign and coastwise trade due to the great European war.

The following table shows the distribution of the ship construction in the two calendar years 1913 and 1914 by materials and rig:

	1913		1914	
Wood.	No.	Gross.	No.	Gross.
Sailing	65	12,999	41	7,085
Steam	870	38,990	769	30,175
Unrigged	426	83,780	248	53,123
Total	1,361	135,769	1,058	90,383
Metal.				
Sailing	4	5,834	5	1,762
Steam	144	229,327	86	157,109
Unrigged	22	11,639	14	6,009
Total	140	246,800	105	165,267
Totals.				
Sailing	69	18,833	46	8,847
Steam	984	268,317	855	187,651
Unrigged	448	95,419	262	59,132
Grand total.	1,501	382,569	1,163	255,630

Of the metal construction reported in 1914, 59 vessels, with an aggregate of 108,275 gross tons, were built on the Atlantic and Gulf coast; 16 vessels, aggregating 15,029 tons, on the Pacific coast; 33 vessels, aggregating 41,160 tons, on the Great Lakes, and 7 vessels, aggregating 803 tons, on the Western rivers. Of the steel vessels built during the year, all but 19 comparatively small boats were propelled by steam. Five were equipped with sails and 14 were unrigged barges.

Bright Prospects for 1915.

Reports reaching the Bureau of Navigation from the various shipyards indicate that the calendar year 1915 will show a marked revival in construction. Orders placed since January 1 show that the industry has received a decided impetus as the result of war conditions, and the officials of the Bureau assert that as British, German and French yards are now specializing almost exclusively on war work it leaves American yards as the only important ones available for the construction of merchant ships. The cost of materials has risen rapidly in England, where some merchant construction is still going forward.

In addition to the construction in the calendar year 1914, the American merchant marine was recruited by the transfer to the American flag, under the Act of August 18, 1914, of 106 foreign built vessels, owned by American citizens, aggregating 376,135 gross tons. Since January 1, thirteen additional vessels, aggregating 73,999 tons, have been added, making a total increase in the merchant marine of 119 vessels of 440,134 tons, which have been brought under the American flag by the new law. The Bureau officials estimate that there are still available for transfer about 450,000 gross tons.

A NOVEL LIGHTHOUSE.

The new unattended lighthouse guarding the approach to the capital of the Island of Guernsey, in the English Channel, utilizes several novel features in providing a complete signal station for mariners at low cost. The rocks of the locality, though made extremely dangerous to navigation by the tidal currents and eddies sweeping over and around them, are small in area, and instead of an ordinary expensive stone lighthouse, an 80-foot tower large enough for automatic apparatus has been built on Platte Fongere, a rock submerged at low water. This tower supplies a light, a fog-horn, and the first ocean telephone call station ever established. The structure itself holds electric motors, air compressors, an automatic acetylene-gas plant and the telephone, and the apparatus is controlled through a submarine cable by a shore station a mile and a quarter away. A selenium cell near the lantern is connected to an alarm bell at the shore station. If the flash every ten seconds is obscured by fog or fails, the bell rings; and each blast of the syren is announced by another bell. The $55,000 outlay for the tower and equipment is less than a fifth of what a stone lighthouse would have cost, while the two operators on shore are the only attendants.

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One of the chief characteristics of these motors is great strength. The frame is massive, the bearings and shaft extra large, and the windings are securely braced against vibration. The bearings are dustproof and rest on three machined seats, a construction that has been found to be the best practice for heavy service.

All coils are form wound and completely insulated to ground before being placed in the slots. The stator slots are straight open; those of the rotor have an overhanging lip which assists in holding the coils in place, but the coils can be removed and replaced without bending as readily as with straight open slots. The shaft can be removed without disturbing the rotor winding.

The bearing shell may be removed and replaced without taking off the lower half of the bearing bracket. The brushes are readily accessible, as may be seen in Fig. 2.

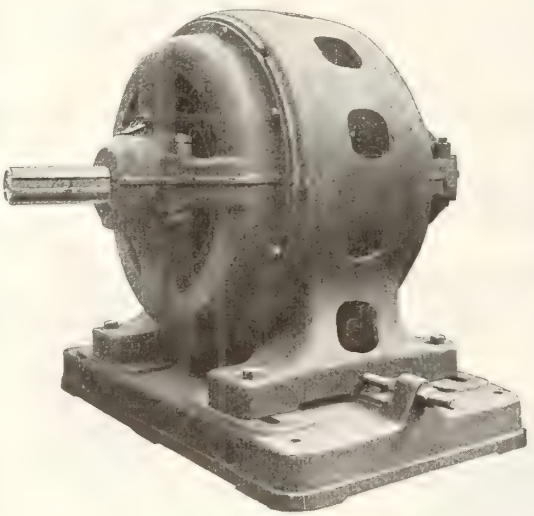

FIG. 1—NEW SLIP RING INDUCTION MOTOR.

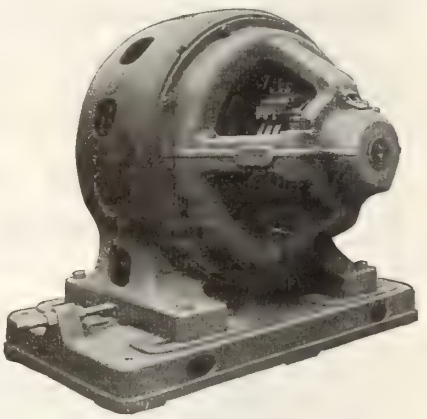

FIG. 2—NEW SLIP RING INDUCTION MOTOR.

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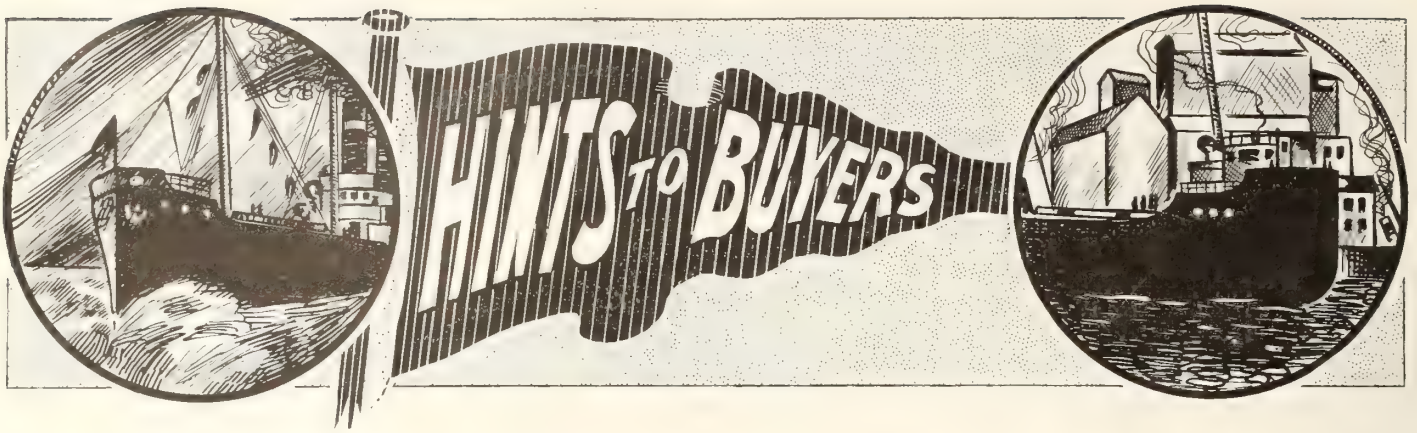

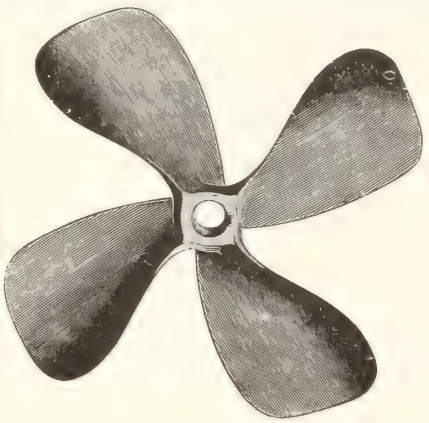

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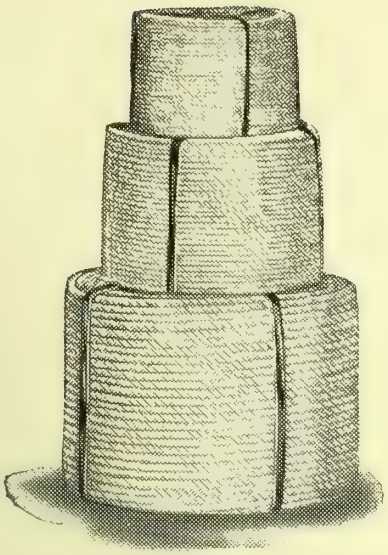

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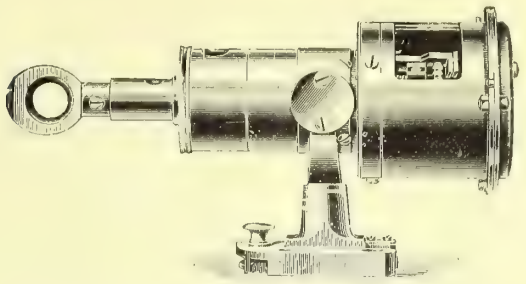

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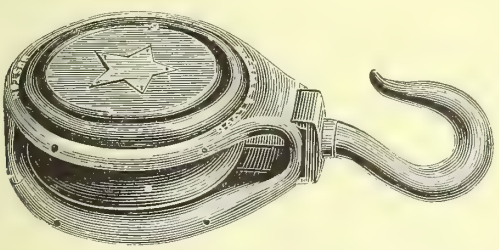

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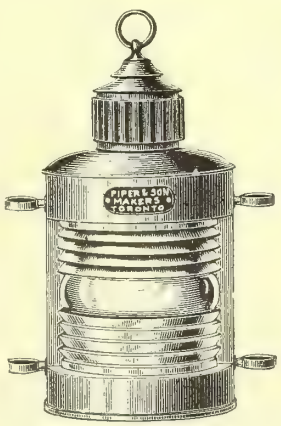

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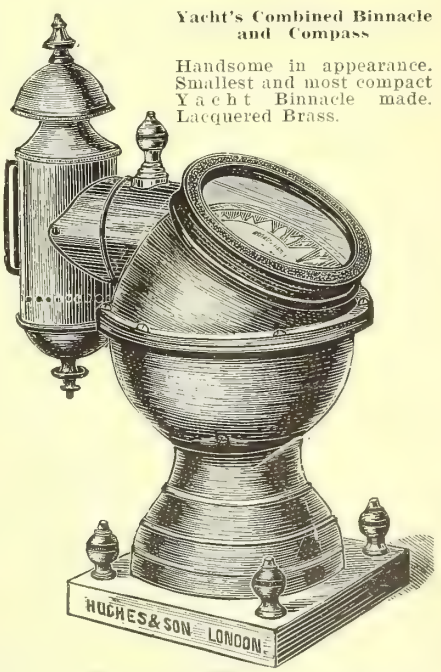

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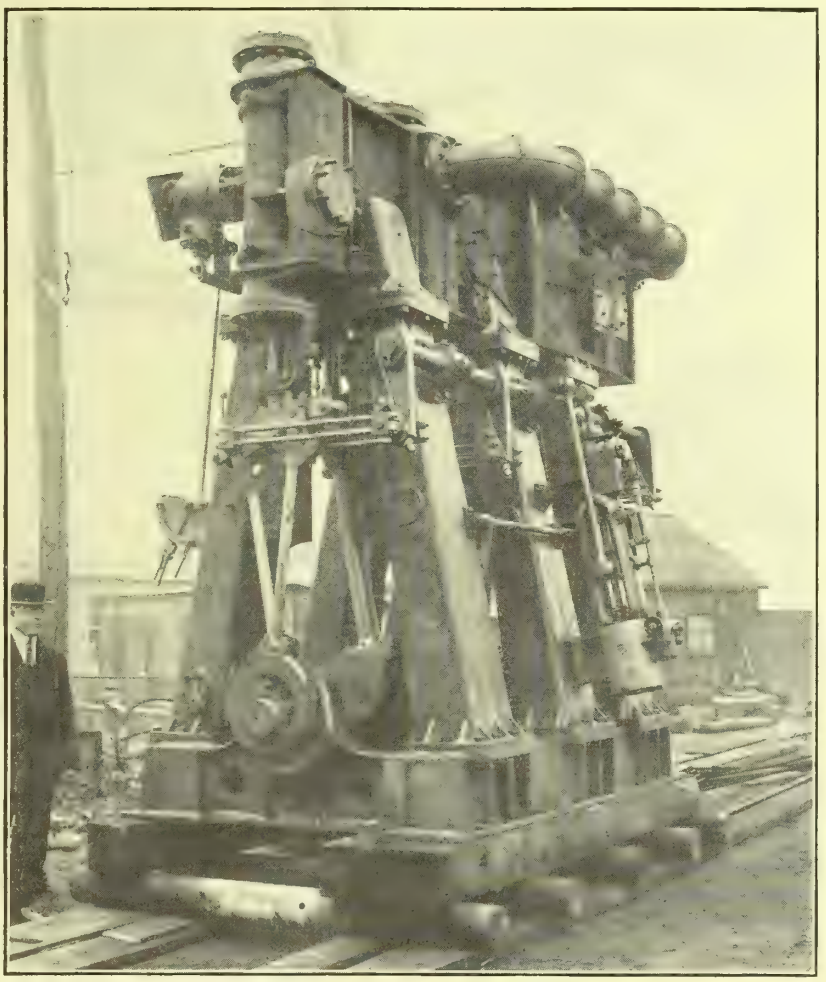

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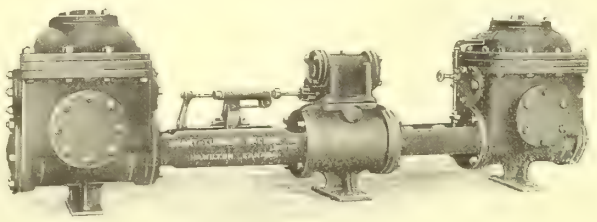

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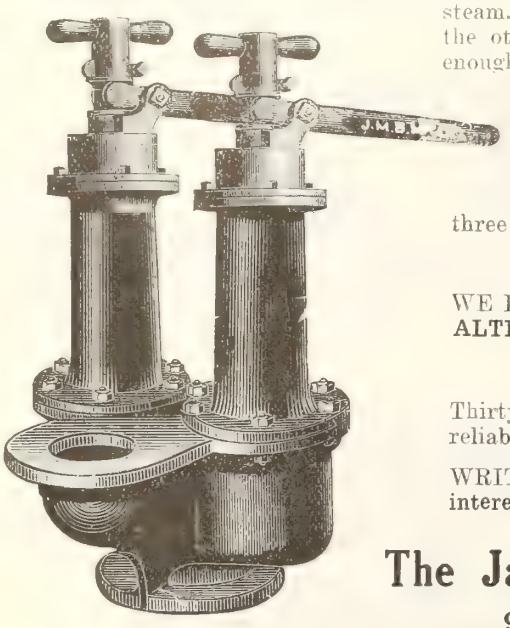

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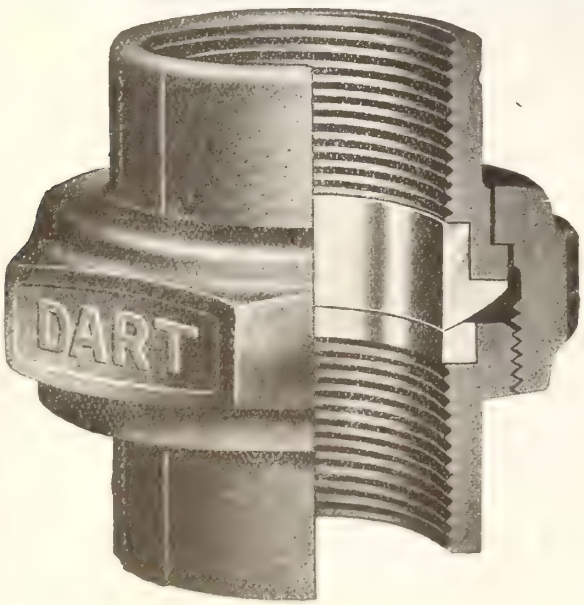

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Submarine Craft Improvement in the Last Fifteen Years*

By C. N. Hinkamp **

The part being played by submarines in the present European War may almost be reckoned as so far the most spectacular. The keenest interest has been aroused in the escapades of these type vessels, and, coincident with it, there has been created a widespread desire to know more of their development history and present-day make-up detail. The subject matter of this article will be found to very satisfactorily meet all requirements in these respects.

IN a general review of the improvements in submarine vessels during the last fifteen years, we find many things that are of great military importance, principal among which is their ability to cruise long distances, and to make these cruises with such regularity that it no longer excites comment. Other items of importance are improvements in signaling and the ability to navigate with comparative ease under all conditions of weather. Habitability has improved, cruising radii have increased, submerged running has developed to an exact science, and in general it is evident that there has been constant advance in submarine effectiveness. This will continue as experience dictates what is and what is not necessary to the development of the boats for the service that they are to perform, namely, the discharging of a torpedo against an enemy.

Engines.

Submarines opened the way for large engines of the internal-combustion type, but the inherent features of submarine design demand absolutely reliable engines of light weight and high speed—a difficult combination to obtain. As the size of the boats increased, the engine horse-power and size increased, and the requirements became more stringent. Designers had difficulty in proportioning the weight necessary for engine reliability and that necessary for the proper trim of the boat. However, the gasoline engine was brought to a high state of efficiency, and the boats that are now fitted with gasoline engines are able to operate as effectively as some of the more modern boats. Before any departure in design is accomplished a great deal of preliminary experimenting must be done, in order to determine the weak points of the new design and avoid them in construction. The departures that have been taken in submarine-boat engines are as follows:—

1.—Gasoline engines, heavy type.

2.—Gasoline engines, light type.

3.—Diesel engines, medium weight, four-cycle.

4.—Diesel engines, light weight, two-cycle.

5.—Diesel engines, heavy weight, two-cycle, double-acting, for seagoing submarines.

6.—Diesel engines, heavy weight, four-cycle and two-cycle, for coast defence submarines.

Each step in the past was a distinct departure. By constant operation and study the defects in engines have been found and are being eliminated, so that in future boats we will be able to decide on a design of engine and feel fairly confident of successful results.

The auxiliaries of submarine engines have been a constant source of trouble, and on them dependence is placed for the solution of the heat problem. Another difficulty lies in the quality of the metal used in the various parts of the engine. In internal-combustion engines the initial pressure is very much greater than in steam engines and the mean effective pressure is but slightly greater. Metal suitable for use in internal-combustion engines is still in the process of development, and it is hoped that the day is not far off when the problem will be solved.

Motors and Batteries.

Advances in electrical engineering have been responsible for many improvements in submarines, especially in the motors, the storage batteries, and the controlling devices for these parts. The motors are built more ruggedly, are of the interpole type, and, generally speaking, can take care of all the current that the battery can supply.

The early control was simple, plain knife switches being used. The first improvement was the enclosing of these switches to minimize the danger from sparks that might ignite stray gasoline vapors. The next step was the contactor-type of control for the main motors. This permits of many variations in the location of the control, but has the disadvantage of being somewhat complex. However, for the large currents now handled it is necessary to have this type, and, except for its complicated construction, it is very much liked.

Batteries are of the lead-plate type. Great improvements have been made in this type of battery in the last few years, but the inherent defects of the type will never be overcome. The greatest disadvantage of the lead-plate battery is danger from chlorine gas. There is no such danger in the Edison battery, which as yet has not been used in submarines because of its initial cost. The rugged construction and the absence of dangerous elements make it appear, however, that the Edison battery, in spite of its cost, is the cheapest in the long run.

Navigating.

One is not impressed with the hardships of the submarine service by the sight of a present-day submarine with its large bridge and adequate protection from the weather; but a view of an older boat with a very low bridge and little or no protection against the weather, would impress one with the desirability of staying ashore on a cold night. The boats, when cleared for action, of course have no bridge on them. When cruising about on the surface, however, there is no reason why a few of the comforts which are possible on a large ship cannot be had. At best, the devices installed are but makeshifts for the real thing on board a large vessel, but their installation eliminates a great many of the earlier difficulties met in navigating the boats.

The older boats had compasses which were mounted in helmets and which were very difficult to read. To-day the boats have not only the gyroscopic compass and standard compass, but a steering compass and, in some vessels, a compass mounted in the top of the periscope for submerged work. All of these additional installations are being specified and required as a result of experience during the last twelve or fifteen years.

The gradual adoption of improved devices for navigation has greatly reduced the possibility of accident to submarines when cruising, both submerged and on the surface. The greatest step in advance is in the engine and motor control. This originally consisted of bell pulls and similar devices, which could not be depended on. To-day, however, very reliable electrically-controlled indicators are installed. These, in addition to being connected to a large bell, are visual, such that the operator is required to look at the apparatus and read the order that is to be executed.

Gyroscopic Compasses.

The variations and deviations of a magnetic compass are not fully realized until they have been met on board a submarine boat. The hull is of magnetic

*From a paper read before the American Society of Naval Engineers.

**Lieutenant, U.S. Navy.

material, and the necessity of having as few protuberances as possible makes it necessary for the compass to be mounted near the hull. In addition, there are large electrical currents always present and in use under many different conditions. To obviate some of the difficulties ,the compass is mounted in a helmet of composition. In order to get the reading of the compass card into the vessel so that the helmsman can read it, a reflector is fitted. In some of the boats, a compass was mounted in the top of the periscope, but it was not generally relied on.

All this is changed in the later boats. Gyroscopic compasses are installed in all these boats, and the captain no longer has to worry about his deviations. Direction has become a thing of electrical engineering plus gravity, rather than magnetic directive force. In a well-adjusted compass all that is necessary is the setting of the speed indicator and the course. It is possible for the helmsman to point the boat by fractions of a degree now, where heretofore it was a question of quarter points. This means a great deal to the man who has to fire a torpedo at an enemy, for it is possible to do so without showing the periscopes, after once having obtained the enemy's bearings.

Pumps, Ballast Tanks, Drainage.

Hydraulic engineering has advanced in strides along with the other branches of engineering—steam, electric and gasoline—and the effect of this advance has shown itself in the installations in the submarines. Considering all the ways that water has to be handled in the boats, greatest progress has been made in the pumping systems. The air blowing has not been changed materially and the principles have been applied in much the same way in all the types of boats; but great strides have been made with the pumps.

The older pumps were of the plunger type of limited capacity and, sometimes, doubtful efficiency. The rotary pumps that were installed were weak, of primitive design, indifferent workmanship, and subject to all the ills of this type of pump. Now the ballast pumps are of the centrifugal pattern, can handle vast volumes of water in a short time against a head of water double that possible ten years ago. The rotary pumps are rugged in design and of a material that will withstand the ravages of hard service. They are built with an idea of being lasting and serviceable. Impellers are so designed and built that they have ample bearing surface, with adequate supports.

In the early boats there was considerable trouble with the shafting. It was of composition and broke very easily. Steel shafting was substituted. By this substitution the shafting became the strongest part of the pump, and eliminated most of the troubles of this type. Pumps of turbine design for the ballast pumps are being experimented with in some boats, and great results are expected, as it is claimed that they can pump against a head of water equal to the depth of test submergence. In the early boats, and some of the later ones, the circulating water pumps for the engines were direct-connected to the engine, through gearing or chain drives. Invariably these systems gave trouble. The latest practice is to have all auxiliary and main pumps independently driven and so arranged that every reasonable contingency is provided for.

Speed in Submerging.

One of the vital military requirements of a submarine is rapid submergence from cruising conditions. For cruising in the small boats it was necessary to rig a complicated bridge for the helmsman and other members of the crew. This took some time to unrig at sea when preparing to submerge. It was generally necessary to stow all the parts inside the boat through the conning tower because the seas were generally too high to permit of opening the main hatch. As the vessels increased in size the freeboard became greater, the danger of shipping a sea much less, and it was more feasible to unrig at sea.

It was not until a year or two ago, however, that the collapsible bridge was designed and installed. With this style of bridge it is only necessary to stow the stanchions inside the conning tower fairwater, to fold the bridge deck down to the sides of the fairwater and secure them in the pockets provided for that purpose. It is possible to get the later boats submerged in a few minutes, because the normal amount of buoyancy is so great as to permit of the admission of a quantity of ballast while the preliminary work of unrigging is going on. Formerly it was necessary to allow about twenty minutes for this operation. It can now be done in from four to six minutes. With the bridge unrigged it takes from two to two and one-half minutes to get under the surface, traveling at three-fourths speed. Design, construction and training are responsible for the enormous reductions in the time necessary to perform any evolution.

Radio, Signals, Communication.

Following the pace set in other fields of engineering, progress has been made in the methods of signaling. The contractors and the signal engineers in civil life have co-ordinated in such a manner that many improvements in this branch have been incorporated in the installations of later vessels. The means of signaling on the surface are practically the same in the submarines as on the larger vessels of a navy; namely, radio, flag, shape and sound in the day time, and radio, sound and light at night.

Submerged, the signaling has taken tremendous strides. In the older boats there was no method of outside communication except that improvised by the crews, and the method was primitive. It consisted in tapping a rivet with a hammer and picking up the sound by holding the forehead against a frame. The introduction of the submarine bell opened the way for the later and better methods of signaling, all dependent upon the principle of setting up vibrations or waves in the water that are detected by means of microphones and heard through the ordinary telephone receiver. To-day the submarine is well equipped to send or receive signals under all conditions, and the methods in use are vastly superior to those used only five years ago. The chief difficulty at present encountered is due to the internal noises of the boat. By the introduction of soundproof compartments this bad feature can be eliminated.

Periscopes.

Improvements in periscopes have been very marked. The early periscopes were frail and leaky, and generally became cloudy after a short time. The periscopes of the present time are rigid, clear and watertight, and the periscope tube is enclosed in an outer tube which has but one joint exposed to the weather. In the early periscopes the image inverted when looking to the rear with the eye piece stationary. In the present periscopes, the image remains erect, no matter what the position of the object glass, and the bearing of the object is indicated by a movable pointer on a fixed dial.

In addition to the feature of erect image in any position of the eye piece, the periscopes have been so arranged that a magnifier can easily be put into operation. This is of inestimable value when picking up objects. As soon as the object is picked up and easily distinguishable, a reversion to the normal eye piece can easily be made. Ordinarily the periscopes are used without the magnifier, in order that objects will appear as they would to the unaided eye, and also that distances will not be distorted. The monocular and binocular periscopes of the present day have all the advantages of the modern telescope or binocular glass.

Armament.

All submarines depend for their defence on their ability to submerge. Their armor is the water over them. Their offensive weapon is the torpedo. The methods of handling the torpedoes have been improved, but even to-day the me-

thods are crude, consume a long period of time, and require, above all, entirely favorable conditions for comparative rapidity. However, progress is being made along well-defined lines, and there is hope that some day in the near future a means of handling the torpedoes will be devised that will not require "all hands" for the job.

The torpedoes are pointed at the target by pointing the boat, and their course is the boat's course at the instant of firing. The angle of the torpedo's course from the direct line—boat to target—is set and determined by means of the torpedo director. These instruments solve the angles automatically, working from certain well-known data, and if the torpedo is well adjusted it will hit either a moving or stationary target. The old method consisted in solving the angles mathematically and then taking a chance.

Torpedo Tubes.

Nowhere were improvements more necessary than in the torpedo-tube arrangement. The older types of boats required that all the tubes be flooded every time that a torpedo was fired out of one tube. The tubes were covered by a cap which seated on the tube ends, thus keeping them watertight. Now, by a door device, controlled from the inside of the boat, any or all tubes may be opened at the same time. The apparent advantages of the later arrangement are many. It is not necessary to pull into the boat, in order to avoid wetting it, a torpedo in a tube adjacent to the torpedo about to be fired. In torpedo practice this advantage is very apparent, as it is possible to work on torpedoes without interruption and fire practice shots at the same time.

Loading Torpedoes.

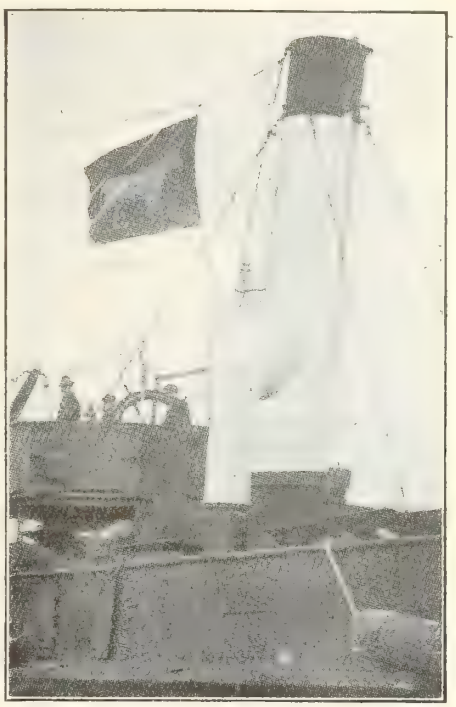
It would appear that, inasmuch as the submarine is designed for the sole purpose of firing torpedoes, adequate means would have been provided for loading these torpedoes in the vessels. It was a long time before proper and adequate cranes or davits were fitted to submarines for the handling of torpedoes. In the early period of development, it was necessary to parbuckle the torpedoes on to skids and load the torpedo into the boat from the tender, using a boat davit for this purpose. It is hoped that better installations for the handling of torpedoes will be designed. At best, torpedo handling is difficult in a submarine, owing to the peculiarities of construction not met in any other class of vessels.

Firing Torpedoes.

Torpedoes are fired by the old lanyard method. In the first boats the commanding officer gave the order to fire to the man at the tube; he controlled the firing entirely. Later the air-control was used. This control was mounted near the periscope, and the commanding officer himself fired the torpedoes when the boat was on the target. It is hoped that, in the near future, the torpedo firing will be electrically controlled, in order to reduce, in a measure, the firing interval.

Conning Tower.

In later designs, the conning tower contains the auxiliary navigating gear, and is so designed and constructed that it can be used for an escape hatch for the crew in case of accident. The latest practice requires all the periscopes to be in the hull proper, the reasons being that this construction makes for greater safety, greater ease in the handling of the boat submerged and, if navigating the boat on the surface in rough weather from the periscopes, permits of



"A BANNER WITH A STRANGE DEVICE"
The quaint flag flown by the vessels engaged in conveying meat to our fleet.
Photo, Courtesy Newspaper Illustrations.

three lookouts, instead of two, one man being in the conning tower.

Tank Construction.

The vessels of the present day have tanks which can withstand a pressure equal to that which the exterior hull can stand. In the earlier classes of vessels some of the tanks were so built that they could withstand a hydrostatic pressure of but from 10 to 50 pounds, and, when submerged, were always kept closed. The construction to-day permits of leaving the tanks open to the sea pressure without danger. In the construction of double-hull boats of various designs it is not necessary for the outer hull to be as strong as the inner hull, as it cannot be deformed, owing to the fact that it is completely filled with water; but the inner hull, or the hull proper, must be built to withstand the hydrostatic pressure of the specified depth to which the vessel is tested. Thus the present-day construction tends towards greater safety in the boats because the operators may safely put a high pressure on their tanks. With the sea valves closed, tanks can be pumped at any depth that the hull can stand.

Cruising Conditions.

The one great feature in the present-day submarine, which makes it possible to undertake long cruises, is the subdivision of the boat into compartments. In addition to the comforts which are possible with this construction it makes for a degree of safety which otherwise would be entirely absent. Any explosion or fire can be localized in the compartment where it originates, and the crews can live safely in the other compartments. In case of a rupture to the outer skin of the ship it is possible to confine the flooding waters to a small area. The latest boats are so built that the flooding of one compartment will not completely sink the vessel.

Heating.

It was not until winter cruising became the rule rather than the exception that the idea of heaters was agitated to any extent. Electric heaters were at first supplied, but these absorbed large quantities of current from the storage battery. This reduced the submerged radius or required constant running of the engines to maintain the battery in a proper state of charge. The latest boats are fitted with steam heaters.

Habitability.

Going to sea in the early submarines is as near as one wants to approach to a real dog's life. Bridges are small, berthing of the men is difficult, there is little heat and the facilities for cooking are far from good. In the later boats these relics of barbarism have vanished to a large extent, and in their places are more modern equipment. The bridges are better, have more navigational facilities, and can be closed in for cold or extremely wet weather. In fact, cruising is more of a pleasure than it used to be, consequently the efficiency of the submarines is greatly promoted and cruising efficiency is next in importance to the actual attack which is so dependent upon it.

When the members of the crew know that they can turn in after a watch in a comfortable place, and feel assured of well cooked food, the general atmosphere is better. Contentment in this service, which requires the best efforts of the men at most unexpected times, and under very trying circumstances, must be most carefully considered. The ad-

vent of fuel oil as fuel for the engines, instead of gasoline, added largely to the safety of the vessel by reducing the danger from fire and explosion.

Cooking.

The comfort of the crew was not considered fifteen years ago. From the viewpoint of the present day, it appears that every discomfort which it was possible to conceive of was quite in order. The modern submarine has every comfort commensurate with the size and service of the vessel. The principal item making for comfort is, of course, properly-prepared food. The early boats used an alcohol stove, contrary to all rules and regulations for the safety of vessels burning gasoline, but the men preferred to take this chance rather than have cold food. For this they cannot be blamed.

As time passed, electric cooking apparatus was installed. This was always subject to the many troubles inherent in early electrical heating apparatus. However, the idea was a step in advance. To-day there is installed a well-arranged oven, four or five independent plates for cooking meats and vegetables, and an urn for keeping coffee constantly hot and on tap when cruising. All of these things, though small in themselves, make for contentment in the crew.

An important consideration for a long cruise is the stowing of adequate fresh provisions and an ample supply of dry food. The early boats had no means whatever of stowing food. What was not carried in cans was not carried at all. Now the vessels are provided with an ice-box large enough to stow three or four, and sometimes five days' supply of fresh meat and vegetables. The crew receive a ration equal to that served on our largest vessels. Dry food is stowed in specially-built lockers. The electric cooking, of course, is somewhat slower than cooking on a range fired by coal, but one man is detailed for this duty, and it keeps him busy. He is able to devote all his efforts to proper cooking. The present installations provide for all emergencies and are considered very good.

Water Stowage.

Owing to the longer cruises taken by the boats, and the necessity for living on board many days at a time, the question of fresh-water stowage became an important one. The usual practice was to carry all the water the fresh-water tanks would hold, fill up the water breakers, hope that nothing would happen to the water, and trust that no one accidentally took a bath. The water was generally apportioned in such a manner that the crew were able to get two washes a day and all they needed to drink. This was very satisfactory; but to insure a ready supply, not only for the crews of the boats, but also for the storage batteries, a small distilling plant is now installed that is capable of caring for the most extravagant needs of a crew.

This may appear to be a needless refinement, but until the tenders for submarines are brought up to the standard that the service requires, and their number and their size is adequate, all these apparently extravagant mechanisms have to be installed. It is economy to have adequate tenders. Then many comforts could be obtained without the necessity of carrying so many auxiliaries on board the submarine, and the consequent saving in weight could be used in the design of more rugged and reliable engines.

Conclusions.

Development has been conservative, improvements have been many, efficiency has been promoted, reliability has been increased, but the field is still open to advances.

MONTREAL TRANSPORTATION CO. TUG "BARTLETT."

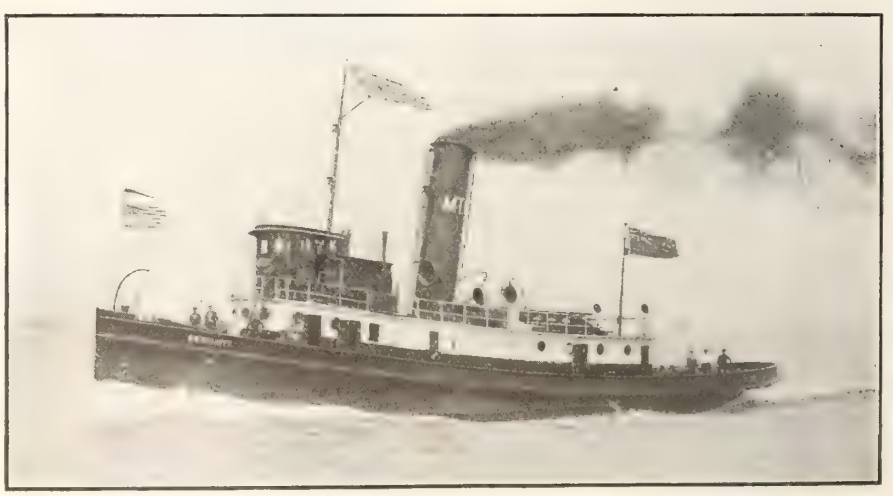
ONE of the best-known vessels engaged in the coal and grain business on Lake Ontario is the Montreal Transportation Co. tug Bartlett. She was designed by John Reid & Co., naval architects, Montreal, and was built in 1908 at the Grangemouth Yard of the Greenock and Grangemouth Dockyard Co.

The length of the vessel is 124.9 feet, the beam 25.1 feet, and the moulded depth 14 feet, Her gross tonnage is 328 tons, and her net register is 41 tons.

The boiler is of the Scotch marine type. The engines are three cylinder, triple expansion, and were built by Muir & Houston, Ltd., Glasgow, Scotland. The cylinders are 17 in. x 27 in. x 43 in. diameter, and the stroke 27 in. The engines are of twenty-five horsepower nominal. Electric light is installed throughout, and a complete outfit of auxiliary equipment to suit the particular service is also installed.

Since arriving in Canada, the Bartlett has been largely engaged in towing the large lake barges of the Montreal Transportation Co.'s fleet from Port Colborne to Kingston, the cargoes of these barges consisting largely of grain and coal. The vessel has, however, made occasional trips to Ashtabula, Ohio, and to some Lower St. Lawrence river ports.

Constructed of steel throughout, the Bartlett is to-day one of the most seaworthy craft on Lake Ontario. With some forty other of the vessels belonging to the Montreal Transportation Co., she has wintered at Kingston, Ont.



MONTREAL TRANSPORTATION CO. TUG "B ARTLETT."

Lake Steamers Chartered.—Of the sixteen large lake freight steamers which have been chartered from the Canada Steamship Lines, it is expected that the greater number will be available for the movement of grain this fall. They have been chartered for six months only, but with the right to the charterers of retaining them for a year if they wish. The steamers which the Canada Steamship Lines relinquish control of for the next six months are as folows: — Dundee, Dunelm, Glenellah, C. A. Jacques, Midland Queen, Donnacona, Acadian, Canadian, Gordon, Empress of Midland, Empress of Fort William, Winona, Turret Cape, Turret Crown and Turret Court. Half of these boats have gone to the Dominion Steel and Nova Scotia Steel and Coal Companies, the first concern needing them to transport steel from Sydney to England, and the second to bring coal and iron ore from New Glasgow to inland ports. It is understood that the rest are to be used in coastwise service.

Shrapnel Shell Service and Constructional Features

Staff Article

Arising out of this European war, not the least interesting feature, if only on account of its novelty, although its significance is much more diversified and potent because of the stimulus given to both our industries and to our Empire patriotism, was that of the decision to manufacture shells in Canada. Interesting data relative to shells generally are here given.

IN view of the fact that shrapnel shell manufacture has developed to an extent hardly anticipated when our Annual Review Number of Canadian Machinery was published on December 31, 1914, and in response to numerous requests from interests only indirectly in touch with affairs mechanical, we have pleasure in reproducing in part the article which appeared in that issue entitled "The Manufacture of Shells, an Impromptu Canadian Industry."

Projectiles, commonly known as shells, have a number of different purposes and

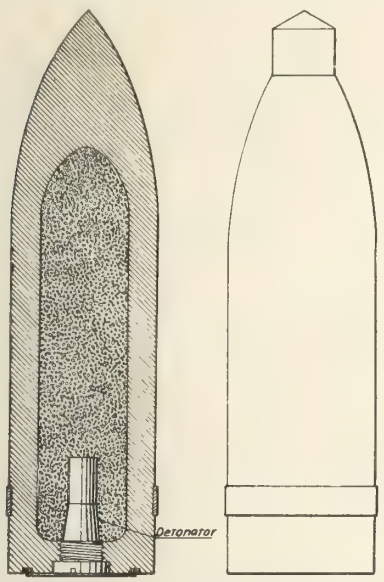


FIG. 1. SIMPLEST FORM OF EXPLOSIVE PROJECTILES.

vary widely in construction. In Fig. 1 is shown a simple and much-used form of explosive projectile. The explosive charge is seen encased in the solid steel of the shell and is provided with a detonator at the rear end which is intended to explode the charge upon impact or immediately afterwards. The left half of the figure represents a projectile designed for the destruction of fortresses, earthworks, etc., where high explosive power is required. When required to pierce hardened steel armor, this shell is provided with a covering of softer metal over the hardened point. Otherwise the shell would simply shatter itself without perforating the hardened projective surface.

Shrapnel Shells.

For the destruction of men and other animate objects, the type of projectile known as shrapnel is employed. Two typical shrapnel projectiles are shown in Fig. 2, and their operation is as follows: The nose or time-fuse can be adjusted to explode the shell at any predetermined time after its discharge from the gun, and an effort is made to have the shell explode about a hundred yards in front of the enemy and directly above him. The case is made of a high grade of steel and is not itself shattered.

The flame from the time-fuse explodes the powder in the central tube and the rear end of the shell. This simply blows the fuse-end off and discharges the whole load of bullets straight ahead as if shot from an enormous shotgun. The explosive charge is not large in comparison to the weight of metal discharged but, as the projectile as a whole has a very considerable initial velocity, each bullet will have sufficient energy to administer a disabling wound at 100 yards, and bullets enough are provided to furnish one for every square yard of surface attacked.

Timing Arrangements

Shells are timed both by clockwork and by a time fuse. A typical example of the latter is shown in Fig. 3. Upon discharge from the gun the inertia of the percussion plunger P causes it to shear off the resistance ring R and fly back against the firing pin A which explodes the primer charge J. The flame from this passes through the hole B and ignites the fixed time-train C. This fixed time-train burns around until it comes to the hole E, through which the flame can pass to the movable time-train at its lower end. The movable time-train burns back until the hole D is reached through which the flame obtains access to the powder G which forms part of the bursting charge of the shell.

It is easily seen that, by rotating the movable ring M so that the holes E and D become further separated around the circumference of the shell, the time required for the train C to burn around to the hole E and back along the movable train to the hole D is increased. The time allowed, of course, depends upon the distance the shell has to travel from the gun to the point where it is desired to discharge the bullets, and if the holes E and D be placed directly in line, the shell will explode but a few feet from the muzzle of the gun.

The time-train rings do not form complete circles so that for transportation, or if it be not desired to use the time fuse, the hole E is set opposite the blank part of the time train C. In case the shell fails to explode through the agency of the time-fuse, it will explode upon impact. Upon firing, the percussion ring H slips back over the plunger which carries the firing-pin K. Upon impact of the shell with some solid object, the whole flies forward, the pin K exploding the primer charge T. This instantly ignites the exploding charge G through the tube O.

The Explosive.

The explosive used in all kinds of shells is, in nearly all cases, a high grade

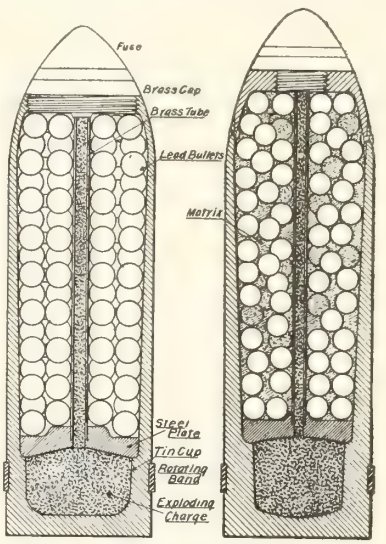


FIG. 2. TYPICAL FORMS OF COMMON SHRAPNEL.

of black powder. Few of the higher explosives are suitable for this purpose. Any of the compounds of nitro-glycerine or other explosives which are liable to detonate by shock are manifestly unsuitable. Many deteriorate in long storage, and acids will react with the metal walls of the projectile. Picric acid or its salts, alone or in combination with other substances intended to make it less sensitive to detonation, are much used in the form of the Japanese shimose and the British lyddite. Great care must be exercised with these, however, to prevent the explosives coming in contact with the metal surface of the shell.

The Canadian-Made Article.

In Fig. 2, the left-hand figure represents a typical 18-pound British shrapnel shell such as, along with 15-pounders, are, at present, being made in large quantities in Canadian factories. The body is

forged by hydraulic pressure from a solid billet of high grade steel, and the machining represents two simple series of operations on turret lathes. After the finishing of the machine work and inspection, the cases are subjected to a heat treatment and oil quenching.

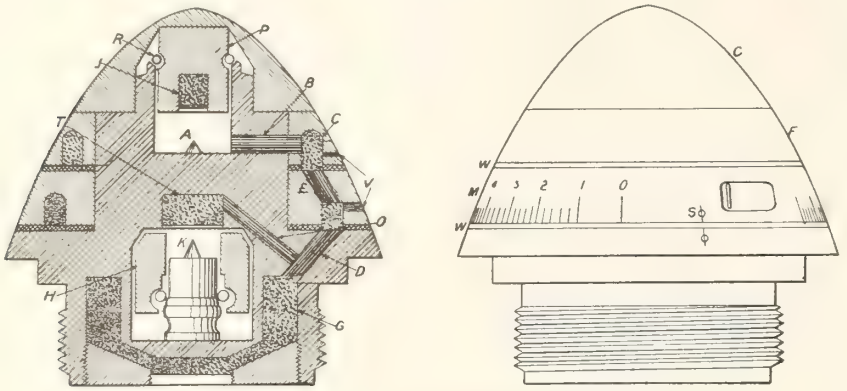


FIG. 3. DETAILS OF ADJUSTABLE TIME FUSE.

The brass cap which screws into the steel body and carries the fuse is turned from the rough casting in four turret lathe operations and is fitted with a brass plug for the purpose of protecting the thread until the fuse, which is made at the Government Arsenals is screwed in place. The fuse is kept from becoming loose and screwing out by means of small grub screws.

The central pipe carrying part of the explosive charge is of drawn brass tubing cut to length; shouldered and threaded to screw into the steel plate at its lower end, and is soldered into the brass cap at the top. The powder is contained in a tin cup which is formed accurately to fit the inside of the base of the shell. This means simple press and soldering operations. The bullets, which are about one-half inch in diameter and, of which 364 are required for each shell, are made of a mixture of lead and antimony and are formed cold in dies under presses. The copper rotating bands are rolled to size and are fastened in place by means of a closing press for the purpose. The interstices between the bullets are filled with a matrix composed of certain forms of pitch or other inflammable substances designed to protect the bullets from deformation when the shell is being discharged from the gun, and to indicate by its smoke, the exact point where the explosion of the shell takes place.

All the work in connection with the making up of the shell need not be done in a single plant or by a single firm. They are completed with the exception of the bursting charge and addition of the fuses, and are packed in special wooden crates designed to hold six each for shipment. The distribution of the contracts for the manufacture of shells in Canada is in the hands of a special shell committee, and the difficulties encountered in placing, collecting, assembling and inspecting the wide variety of the work involved are much greater than is realized by the man not directly in touch with the task. Some seemingly insurmountable obstacles have been met and overcome and, at the present time, the work is being done almost entirely in Canada, by Canadians, creditably alike to the latter and to the Empire of which they form a part.

RANGE FINDING AFLOAT.

"A RANGE FINDER on a battleship, is an ingenious optical contrivance which gives the observer who looks into it exactly the view he would have if his eyes were twenty-one feet apart," says a U. S. navy officer. An enemy's ship, therefore appears as if seen from two points of view separated by that distance.

"This line, twenty-one feet long, represents the base of an imaginary triangle, the apex of which touches the hostile vessel. The instrument shows the two angles at the base of the triangle, which, together with the known length of the base, give the distance of the enemy's craft, or in other words the range.

"There are three or four other range finders in various places, on top of the turrets or elsewhere, each instrument being erected on a tripod. The observations of all of them are communicated by telephone to the plotting room, which is under the water line of the ship. There the whole problem is worked out on a mathematical basis, but with the utmost celerity, and thence the proper ranges for the guns are sent to the turrets.

"Officers of exceptional cleverness are employed in this kind of work, on which so much depends. The spotting room is provided with all sorts of instruments, including a master dial, with a switch which, when turned to one figure or another, causes corresponding figures to appear on dials in all of the turrets.

"It might be said incidentally that the range finders give ranges that are only approximately to be relied upon, because various conditions may affect the shooting. Thus, for example, gunpowder does not give in damp weather the same propelling force to the projectile as in dry weather. It is particularly at long range that the finders are useful. At short range the gunners are able to get along very well without their help, each turret officer doing his own spotting and correcting his range by observation of the fall of his shells.

"The fighting of the ship is directed by the captain from the conning tower, in which are the steering wheel, a compass, voice tubes, engine signals, and telephones communicating with all parts of the vessel. It is he who gives the order to open fire on the enemy, who governs the steering of the vessel, and who indicates when torpedoes are to be discharged."

RANGE OF NAVAL ACTIONS.

ONE of the uncertain points in naval warfare is the range at which an action between battleships of hostile fleets would take place, and this is a question that has yet to be solved. In the Russo-Japanese war the range was frequently 5.000 yards, but since that time the size and accuracy of the guns have increased, and it is generally considered that 8.000 to 10,000 yards, will be the distance at the present time. Some of the later battleships have guns with a longer range than 10,000 yards (notably the 13.5 in. and 15 in. types), but it is doubtful if in the North Sea, even in clear weather, ships could be properly seen when beyond this limit, and it is not at all unlikely that the lower figure of 8,000 yards (or something under five miles), will represent the distances between the capital ships in a naval battle.

A 12-in. gun (50 calibres) would almost certainly penetrate the armor of any British or German warship at 10.000 yards, and it may appear from this that the employment of the 13.5 and 15-in. models is therefore valueless. This would be so were it not for the fact that the weight of the charge in the larger calibre projectiles is much increased, with a corresponding effective destructive value of the shell. The number of rounds that can be discharged is also considerably more in the 13.5 and 15-in. weapons owing to the lower velocity of discharge, and whereas only 150 to 200 shells can be fired with the 12-in. 50-calibre gun, from 400 to 500 are possible with the 13.5-in. and 300 to 400 with the 15-in. type.

BELLIGERENTS NAVAL REINFORCEMENTS.

THE following list comprises naval vessels of all classes which so far as is known have been or will be completed before the end of the present year:

Great Britain.

Battleships completed. — Agincourt, 27,500 tons, fourteen 12-in. guns; Erin, 23,000 tons, ten 13.5-in. guns; Benbow, 25,000 tons, ten 13.5-in. guns; Emperor of India, 25,000 tons, ten 13.5-in guns; Queen Elizabeth, 27,500 tons, eight 15-in. guns.

Battleships building.—Warspite, 27,500 tons, eight 15-in. guns; Valiant, 27,500 tons, eight 15-in. guns; Barham, 27,500 tons, eight 15-in. guns; Malaya, 27,500 tons, eight 15-in. guns; Royal Sovereign, 26,000 tons, eight 15-in. guns; Royal Oak, 26,000 tons, eight 15-in. guns; Revenge, 26,000 tons, eight 15-in. guns; Ramilies, 26,000 tons, eight 15-in. guns; Canada, formerly Almirante Latorre (building for Chili), 28,000 tons; ten 14-in. guns.

Battle cruisers completed.—Tiger, 28,000 tons, eight 13.5-in. guns.

Cruisers now or nearly all completed.—Arethusa, 3,520 tons, two 6-in. and six 4-in. guns; Undaunted, 3,520 tons, two 6-in. and six 4-in. guns; Aurora, 3,520 tons, two 6-in. and six 4-in. guns; Galatea, 3,250 tons, two 6-in. and six 4-in. guns; Inconstant, 3,520 tons, two 6-in. and six 4-in. guns; Royalist, 3,520 tons, two 6-in. and six 4-in. guns; Penelope, 3,520 tons, two 6-in. and six 4-in. guns; Phaeton, 3,520 tons, two 6-in. and six 4-in. guns; Calliope, 3,800 tons, three 6-in. and six 4-in. guns; Caroline, 3,800 tons, three 6-in. and six 4-in. guns; Carysfort, 3,800 tons; three 6-in. and six 4-in. guns; Champion, 3,800 tons, three 6-in. and six 4-in. guns; Cleopatra, 3,800 tons, three 6-in. and six 4-in guns; Comus, 3,800 tons, three 6-in. and six 4-in. guns; Conquest, 3,800 tons, three 6-in. and six 4-in. guns; Cordelia, 3,800 tons, three 6-in. and six 4-in. guns.

Monitors completed.—Humber, 1,200 tons, two 6-in. and two 4.7-in. guns; Severn, 1,200 tons, two 6-in. and two 4.7-in. guns; Mersey, 1,200 tons, two 6-in. and two 4.7-in. guns; Unnamed, 4,900 tons, two 9.4-in., four 6-in. and six 4-in. guns; Unnamed, 4,900 tons, two 9.4-in., four 6-in. and six 4-in. guns.

Destroyers (flotilla leaders) completed.—Broke, Faulkner, 1,600 tons, six 4-in. guns; Marksman, Lightfoot, and probably more purchased.

Destroyers completed.—Lance, Laverock, Leonidas, Milne, Moorson, Mastiff, Lookout, Lucifer, Meteor, Minos, Miranda, Manly, Morris, Mansfield, Myngs, Murray, Matchless.

Submarines.—Unknown.

Germany.

Battleships.—Konig,| 25,800 tons, ten 12-in. guns; Kronprinz,* 25,800 tons, ten 12-in. guns; Markgraf, 25,800 tons, ten 12-in. guns; Grosser Kurfurst, 25,800 tons, ten 12-in. guns.

Battle Cruisers.—Derflinger, 26,600 tons, eight 12-in. guns; Lutzow, 26,600 tons, eight 12-in. guns; Erz Hertha,* 26,600 tons, eight 12-in. guns; ex. Greek Salamis,* 19,500 tons, eight 14-in. guns.

Cruisers. — Karlsruhe, Rostock (3) Grandenz, Enz. Niobe,* Enz. Gefion,* Enz. Gazele,* Unnamed, 4,500 tons; Unnamed, 4,500 tons, eight 5-in. guns (building for Russia).

Destroyers and Submarines.—Uncertain.

France.

Battleships. — France, 23,467 tons, twelve 12-in. guns; Paris, 23,467 tons, tons, ten 13.4-in. guns; Bretagne,* 23,-tons, ten 13-4-in. guns; Lorraine,* 23,-550 tons, ten 13.4-in. guns; Provence,* 23,550 tons, ten 13.4-in. guns.

Destroyers.—About nine completing.

Japan.

Battleships.—Fu So,* 30,600 tons, twelve 14-in. guns.

Battle Cruisers.—Hi-Yei, 27,500 tons, eight 14-in. guns; Haruna,* 27,500 tons, eight 14-in. guns; Kirishima,* 27,500 tons, eight 14-in. guns.

Destroyers.—Two.

Russia.

Battleships. — Pollava, 23,300 tons, twelve 12-in. guns; Petropavlovsk, 23,-300 tons, twelve 12-in. guns; Sevastopol, 23,300 tons, twelve 12-in. guns; Ganfoot, 23,500 tons, twelve 12-in. guns; Ekaterina II.,* 22,500 tons, twelve 12-in. guns; Imperatrza Maria,* 22,500 tons, twelve 12-in. guns; Alexander III.,* 22,500 tons, twelve 12-in. guns.

Cruisers.—Svietlana, 6,750 tons, twelve 6-in. guns; Greig, 6,750 tons, twelve 6-in. guns; Bootakof, 6,750 tons; twelve 6-in. guns; Spiridoff, 6,750 tons, twelve 6-in. guns (all not likely to be finished during the war).

Austria.

Battleships.—Szent Istvan,* 20,000 tons, twelve 12-in. guns.

*Building.

FIRST CONTINGENT TRANSPORT PAYMENTS.

A statement of payments to steamship companies for the transport of the first contingent to England was given in the House of Commons on Feb. 23. The ships were refitted as transports at the expense of the Government, the cost of victualling being also borne by the Government. The payments were:—

Allan Line—Corinthian , $17,841.20; Grampian, $36,635; Scandinavian, $29,-440; Scotian, $25,116; Sicilian, $17,831; Tunisian, $25,734.

Atlantic Transport—Manhattan, $34,-142; P. V. G. Mitchell-Manitou, $30,-461; Lapland, $39,056.

Red Star—Zeeland, $28,964.

White Star—Megantic, $36,198.

Dominion Line — Canada, $45,819; Laurentic, $72,464.

Canadian Northern—Royal George, $54,243.

Canadian Pacific—Ruthenia, $17,992; Tyrolea, $18,335; Montezuma, $20,342; Montreal, $21,033; Monmouth, $9,915; Virginian, $26,175.

Canada Steamship Lines—Bermudian, $20,184.

Cunard—Alaunia, $65,237.

Robert Reford Company—Andania, $48,928; Franconia, $66,578; Invernia, $69,486; Saxonia, $69,578; Cassandia, $38,590; Lakonia, $22,805.

Donaldson Line—Athenia, $42,184.

Royal Mail Steam Packet Company—Arcadian, $21,751; Caribbean, $14,171.

Canadian Northern—Royal Edward, $45,080.

Thompson Line—Devonia, cancelled, $1,938. The cost of fitting and victualling approximated that of the hire of the ships.

EARLY OPENING OF NAVIGATION.

THAT the opening of navigation this year will be much earlier than usual is indicated in a message received by several steamship companies from the Dominion Department of Marine announcing that the water had been let out of the Cornwall Canal. The indications are that all the lower canals will be opened about April 15th.

According to reports prepared by the Meteorological Service of Canada, there is more ice over the extreme western part of Lake Ontario and less over the central and eastern portions than existed two weeks ago. The reports show that the main channel in St. Mary's River is open at Sault Ste. Marie, while the ice in Green Bay remains solid and stationary. The ice has commenced to run freely from Lake St. Clair. In Lake Erie the fields remain along the south shore from Sandusky eastward to Buffalo, while no fields are reported along the north shore.

In Lake Ontario there are a few small fields reported over the central and eastern portions, but the ice is softening so rapidly that Lake Ontario will be entirely clear when the canals open.

In Lake Huron there are no fields noticeable off Detour, but, from Presqu' Isle to Thunder Bay Island, the fields extend beyond vision. There is open water south of Thunder Bay.

PROGRESS IN NEW EQUIPMENT

There is Here Provided in Compact Form a Monthly Compendium of Marine Engineering Product Achievements

UTILIZATION OF EXHAUST STEAM IN A SHIP YARD

SPEAKING generally, it may be said that the power generating methods of industrial plants have relatively stood still while central station and marine practice has been forging ahead. By means of the steam turbine, the high vacuum condenser, improved boiler room practice and similar expedients, fuel costs in large power stations have been reduced to a minimum. Large numbers of industrial plants have, on the other hand, been loath to discard machinery as yet unimpaired, and are still operating reciprocating engines of only moderate steam economy, non-condensing or with low vacuums. However, by introducing a low-pressure turbine, many of these plants could greatly reduce fuel bills while retaining to good advantage, their present equipment.

As an example, the shipyard of the Newport News Shipyard and Dry Dock Co., of Newport News, Va., was formerly supplied with electric power by three McIntosh & Seymour engine-driven generating sets of 600 k.w. each, one of which was operated continuously for carrying the yard load, while the other two were used only when pumping out dry docks. The demand for power increasing, it was found upon investigation that sufficient exhaust steam could be obtained from the four air compressors and four hydraulic pumps in use in the yard to operate a 1400 k.w. low pressure turbine. This would be more than sufficient to carry the yard load, while the reciprocating units could be retained as spares, to be used only when pumping out dry docks.

Because of the greater flexibility of control of direct-current motors as compared with alternating current motors, and also because of the necessity for direct current for operating the dry dock pumps at varying speeds during the pumping out, direct current is practically indispensible in a plant of this kind. The alternating current generator is the only form of electrical generator adapted in moderate or large sizes to run at speeds anywhere near those which are best for turbine efficiency and simplicity, but to have installed a turbo-alternator set would have required the use of rotary converters and transformers to supply the direct current required to enable the new unit to work in conjunction with the engine-driven units already in place.

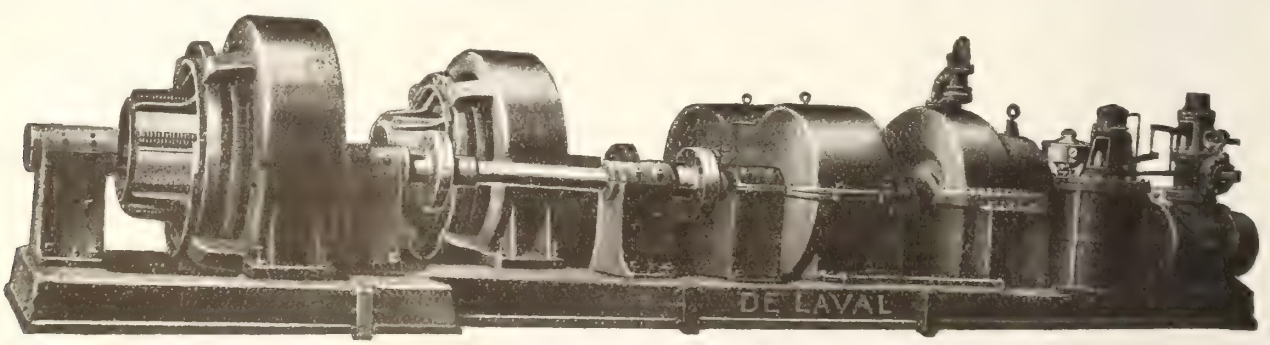
Gear Driven Generator

Because of its much greater simplicity, less cost for the complete equipment and high overall efficiency, a gear-driven direct-current generator was selected and installed. This unit, shown in the accompanying illustration, consists of a DeLaval low-pressure turbine, operating at 3000 r.p.m., driving two 700 k.w. Crocker-Wheeler direct-current dynamos at 500 r.p.m. The turbine is of the pressure stage type and receives the exhaust from air compressors and hydraulic pumps at a pressure of about 1 lb. gauge, exhausting to a surface condenser having 7015 sq, ft. of cooling surface and served by a rotative dry vacuum pump and a two-stage turbine-driven hot-well pump. A second surface condenser in the same power house can be connected up if necessary to take care of unusual loads.

The double generator combination results in an exceptionally neat arrangement for a unit of this capacity, as the pressures on bearings and gear teeth are greatly reduced as compared with a single gear transmitting the same power, while the generators admit of series and parallel connection for two different voltages. It is also possible to operate one generator alone in case of accident to the other.

The normal yard load of about 1000 k.w. at 220 volts is regularly carried by the turbine-driven generators, while when pumping out a dry dock, the combined load of approximately 2300 k.w. is carried by connecting one of the 600 k.w. engine-driven generators in series, or as a booster, to the turbo-generators, thus supplying approximately 500 volts for the two large pump motors in the dock pump house. By varying the field of the engine-driven generator, which can be done by the attendant at the dock pump house, the pump load can be controlled. A small centrifugal pump, connected to the regular 220-volt circuit of the yard, is also installed for draining the dock.

While records of a steam consumption are not available, the fact that an increased electrical load is now being carried by utilizing exhaust steam formerly wasted from air compressors and pumps indicates a large economy in fuel costs.



DE-LAVAL CLASS "D" PRESSURE STAGE TURBINE ARRANGED FOR MIXED FLOW SERVICE.

NEW DOXFORD DIESEL TYPE MARINE ENGINE.

FOR some considerable time, the Junkers type of internal combustion engine has been under discussion in the technical press and its general principles have thus become more or less familiar. Several of these engines have been constructed by William Doxford & Sons, shipbuilders of Sunderland, England, and have been put through very exhaustive and careful tests. As a result, expert opinion speaks very highly of this new type engine.

The Diesel type of oil engine differs from other internal combustion engines in that the oil is sprayed into the combustion chamber gradually throughout a perceptible part of the explosion stroke. Air alone is taken in during the suction stroke and is compressed to from 500 to 600 pounds per square inch, the temperature rising to approximately 1000° F. (a dull red heat) or

more. Oil is sprayed in so that a uniform pressure of 500 pounds per square inch is maintained throughout the first part of the stroke, the amount of expansion depending upon the cutting off of the oil supply. The thermal efficiency of the Diesel engine is remarkably high and is credited largely to the high compression used. For the same and other reasons, the mechanical efficiency is somewhat lower than a few other types of engines.

The very high pressures used and consequent high temperatures have caused a number of difficulties to be met with in the construction and operation of Diesel engines. The principal troubles are connected with the exhaust valves, cylinder liner, cylinder cover, piston and bearings. In spite of the high efficiencies obtained, compactness and other advantages, their uncertainty of continuous working has, however, made them slow to be adopted by ship owners in general.

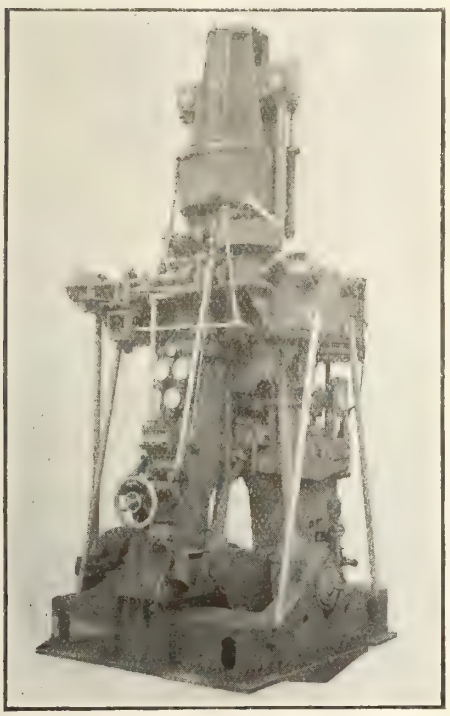


FIG. 1. OPPOSED PISTON DIESEL MARINE ENGINE—FRONT VIEW.

Junkers Principle Application.

The Junkers principle as embodied in the latest Doxford engine involves two pistons working in opposite directions in a single headless cylinder. The cylinder is simply a tube, the fuel being introduced into the centre or combustion chamber between the pistons. The oil is admitted by two nozzles in opposite sides of the cylinder in a more or less tangential direction. This tends to give it a whirling motion, so that it does not impinge directly upon either the pistons or the cylinder walls. The effect of the explosion is to drive the pistons apart, thus allowing a very rapid expansion of the gases between them. The exhaust escapes through a ring of ports uncovered by the upper piston when at the upper end of its stroke and, at the same time, the scavenging air is admitted by a ring of smaller ports uncovered by the lower piston, thus giving the air a straight sweep through the engine.

The most troublesome part of the Diesel engine—the exhaust valve—is thus eliminated entirely. The usual way of overcoming this trouble heretofore has been to keep on hand a number of spare parts so constructed that the one in use could be quickly replaced by a new one upon becoming burnt or clogged. The cylinder head is, of course, replaced by a piston and is thus also eliminated. The cylinder liner in the new type has been found to suffer less than in the old, due probably to the thorough scavenging and to the fact that it is subjected to no longitudinal stress due to the reaction between piston and cylinder head. This also allows the walls to be made much thinner.

General Constructional Features.

As seen in the illustrations, the engine is made up of a heavy cast-iron marine type frame upon which the cylinder is mounted in a vertical position. The lower piston, piston rod, connecting rod, etc., are arranged as in the ordinary marine steam engine, with the exception that the stroke is rather short as is also the connecting rod. The upper piston in the same cylinder works in the opposite direction at any given moment, and has its piston rod projecting upwards to a sort of cross-head which, in this case, takes the form of a compensating arm placed in a fore-and-aft direction. From the ends of this beam two rods lead vertically downwards, one on each side of the cylinder and each to its own cross-head and connecting rod.

The crank shaft is a heavy built-up affair having but two bearings fitted to spherical beds. Between these bearings are the three cranks, the two outside ones being opposite to that in the centre. It has been found that, with the excessive pressures employed in Diesel engines, springing of the crank shaft is very hard to eliminate, with the result that, no matter how large the surface of a rigid bearing, very heavy pressure is bound to be exerted upon a small part of it. By the reduction of the number of bearings to two self-aligning ones, and the adoption of forced lubrication, the Doxford people have eliminated the greater part of the usual bearing troubles.

Valve Gear Features

Doing away with all valves for exhaust and scavenging together with their driving gear has greatly simplified the necessary valve gearing, even though there are two fuel valves. Six cams—two ahead, two astern and two air-starting—are mounted upon a single sleeve. The engagement of either ahead or astern cams is accomplished by sliding the cam sleeve upon its spindle. The valve rockers are carried upon what might be called a reversing shaft, which can be rotated from the starting platform by a hand-wheel, and this shaft has to be in a neutral position before the lever which slides the cams along the shaft can be operated. The end of the rotation of the reversing shaft in one direction puts the fuel valve rockers out of action and the starting valve rocker in. When the engine is started, the shaft is rotated in the opposite direction, and the fuel valves thus brought into action.

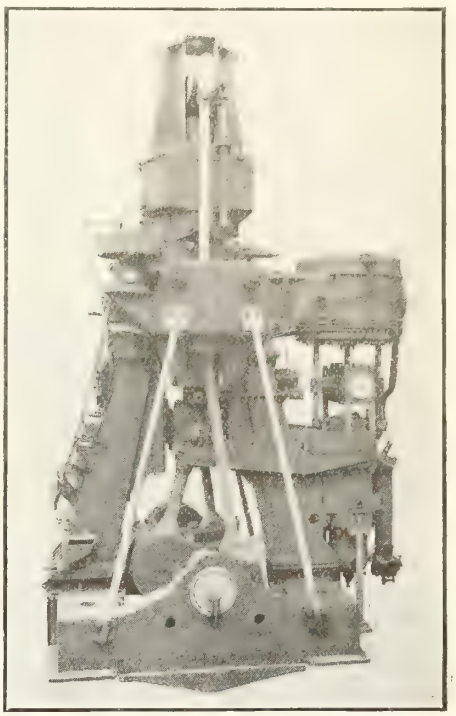


FIG. 2. NEW DIESEL MARINE ENGINE. END VIEW SHOWING CRANK ARRANGEMENT.

The rockers do not bear directly on the fuel valve stems but on the outer ends of small levers which have their fulcrums on the fuel valve casings. By this means the rotation of the shaft moves the roller on the rocker across the axis of the cam, while changing over from starting air to oil. By continuing the motion after actual engagement, the inner end of the rocker makes contact with a point nearer the fulcrums of the little levers on the fuel valve so that the lift of the valve and the time of opening can be changed. In this way the speed of the engine is controlled.

The fuel pump is driven from the cam shaft, which also carries the centrifugal governor acting on the pump

suction valves, and is itself driven by the ordinary vertical shaft and skew gearing. The scavenging pump and the 3-stage air compressor are driven off the usual link motion common to marine engine practice, and are well shown in both cuts. The air is compressed in three stages to 100 atmospheres or about 1500 pounds per square inch, and that for scavenging is admitted under pressure of about 4 pounds per sq. in.

Cooling Arrangements.

A most important consideration in connection with Diesel engines is the effective cooling of pistons and cylinder. A distinct advantage of the opposed piston construction is that all surfaces surrounding the combustion chamber can be water-cooled with comparative ease, which is not true of the cylinder fitted with a head. In the Doxford engine, the water is conveyed to the lower piston through a hollow rocker arm on the cross-head. This system gives a very small rotary motion in the glands and the packing lasts for a long time without leaking. The upper piston receives its supply through telescopic tubes easily seen in the illustration and, while this has been somewhat criticized, it is a neat arrangement and has evident advantages. The drawback with the arrangement is the difficulty of keeping the glands tight and it must also be borne in mind that fresh water is often an expensive commodity at sea. The cooling of the cylinder is a simple matter and requires no special description.

Engine Dimensions.

It might be expected that the opposed piston type of engine would necessarily be very high. This, however, is not the case. The rapid increase of cylinder expansion space permits of a very short stroke, and besides this, the connecting rod is made very short—2½ times the stroke. The height of the engine giving 850 horse-power is 19 feet, which is but little higher than a compound steam engine of equal power. The lateral space occupied is very much less. The bore of the cylinder is 19 11-16 inches, and the stroke 29½ inches. The opposed cranks tend to neutralize the bending moment to which the crank shaft is subjected; nevertheless, considerable unbalanced thrust and consequent springing has been found to exist. This has been amply provided against by spherical bearings on crank shaft and rod ends.

The opposed mechanisms do not balance each other completely, as the parts attached to the upper piston are somewhat larger and heavier than those attached to the lower one. The greater part of the vibration, however, is attributed to the effect of angular thrust of the connecting rods which must be great when short.

Test Data.

After a number of unofficial tests by the builders, covering a wide range of loads, the engine was handed over to Lloyd's. Under the supervision of J. T. Milton, Chief Surveyor of that corporation, a test run covering a period of 35½ days was made, the actual running time being 32 days, 21 hours. The power developed was absorbed by a Heenan & Froude dynamometer and certified indicator cards were taken periodically. The fuel used during the trial was Anglo-Mexican of sp. gr. 910, flash point 175 deg. F., and having a heat value of 19,100 B.t.u. per pound.

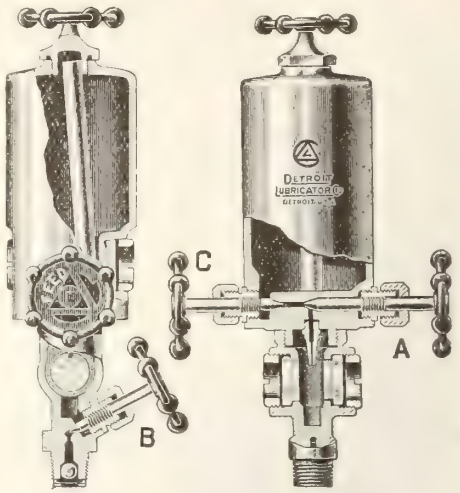
During the test, the maximum I.H.P. recorded was 870, the mean effective pressure being 140 pounds per square inch. This represents an overload of about 40 per cent., which was the maximum capacity of the fuel oil pumps. The average I.H.P. throughout the test was 650 which, with 480 B.H.P. recorded by the dynamometer gives a mechanical efficiency of 77½ per cent. This, considering the number and nature of auxiliaries to be driven, is quite remarkable and makes that of the steam boiler and engine combination look small indeed. The fuel consumption averaged 0.32 pounds per I.H.P. per hour, or the equivalent of 1 horse-power from 6,012 B.t.u. This compares very favorably with the best gas engines which require 8,500 B.t.u., and a compound engine steam plant requiring 13,980 B.t.u.

The speed of the engine averaged 112 r.p.m., and was varied from 70 to 135 r.p.m. without difficulty. The consumption of lubricating oil averaged ½ gal. per hour, which is remarkably small for oil engines and compares favorably with that of steam engines.

The production of a reliable oil engine is conceded to be most important, particularly in connection with cargo boats where every foot of space not occupied by engines and fuel can be turned to profit, and the further development of this apparently practical form of Diesel engine will be watched with great interest by all ship owners and seafaring engineers.

AMMONIA CYLINDER LUBRICATOR.

THE Detroit "600" Lubricator, which is manufactured by the Canadian Detroit Lubricator Co. of Walkerville, Ont., is designed and constructed especially for use on ammonia cylinders. It may be attached to the ammonia cylinder or to the pipe line leading to same. Lubricators for steam or air cylinders are constructed of brass, but lubricators constructed entirely of brass are not satisfactory on ammonia cylinders because of the excessive corrosion, consequently the "600" Detroit is constructed of material that will resist the action of the ammonia fumes. This lubricator is easily operated, and gives constant lubrication to the cylinder under every condition of service.



DETROIT AMMONIA LUBRICATOR.

The lubricator is substantially made so as to withstand excessive pressures, vibration and rough usage. It has bulls-eye sight feed and gauge glasses which are easily kept tight and not readily broken. The filler plug and valves are provided with metal handles.

The lubricator may be connected direct to the cylinder, and using, if desired, a short piece of pipe and elbow. No separate valve is used, as the valve B in the support post cuts off the lubricator from the cylinder when it is desired to repack the glasses, clean the lubricator, etc. The valve C controls the admission of oil to the oil passages, and should be used to operate the lubricator, making it unnecessary to change the adjustment of valve A, which need not be disturbed after once being properly regulated.

DETROIT AMMONIA LUBRICATOR.

PRACTICAL ARTICLES BY OUR READERS

Readers are Invited to Contribute to this Department with Short Articles or Comments — We Pay for all Available Material.

SETTING SIMPLE DUPLEX STEAM PUMP VALVES.

By H. A. W.

IN a duplex pump, the type of valve used is the ordinary D slide. The steam is not used expansively because water and other liquids usually pumped are incompressible as far as all practical purposes are concerned.

In a duplex pump the right-hand piston-rod actuates the left-hand valve-stem and vice versa. When one is standing at the steam end of the pump and looking forward toward the water end, the right piston-rod moves the left valve-stem, and it will be noted that the valve moves in the same direction as the piston-rod. The case of the left piston-rod is somewhat different. This left piston-rod actuates the right valve-stem, but the levers are so arranged that the valve is moved in the opposite direction to that of the piston-rod.

Figures 1 to 4 inclusive represent diagrammatically the two cylinders with valves, pistons, levers, etc., of a duplex pump, steam end. In each case the upper cylinder is considered the right cylinder and the lower the left. The arrows indicate the direction of the flow of steam and also the piston that moved last and the direction in which the piston moved. Placing the right piston at the head end of the cylinder and the left piston at the frame end, the edges of the valves should be just flush with the edges of the ports as shown in Fig. 1. Right cylinder should have a full port opening frame end, and left cylinder should have a full port opening frame end also. When operating, the following cycle of events occur:

The right piston remains stationary while the left piston moves from the frame end to the head end of the cylinder. At the same time, the right valve is moved so that when this left piston has reached the end of its stroke the right valve is just flush with the edge of the port, giving a full port opening, head end, as shown in Fig. 2. Now the steam causes the right piston to move to the frame end of the cylinder and at the same time the left valve is moved so that when this right piston has reached the end of its stroke, the edge of the left valve is just flush with the edge of the port, giving a full port opening, head end, to the left cylinder, as shown in Fig. 3. In setting the valves, after it has been ascertained that conditions shown in Fig. 1 prevail, the pump should be placed in position shown in Fig. 3 to see if these conditions also prevail. If these conditions exist in both instances the valves are set.

To continue to trace the events throughout a cycle it will be seen that with the conditions existing in Fig. 3 the left piston moves toward the frame end of its cylinder and also moves the right valve. These conditions are shown

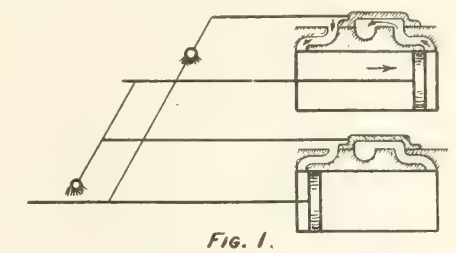


FIG. 1.

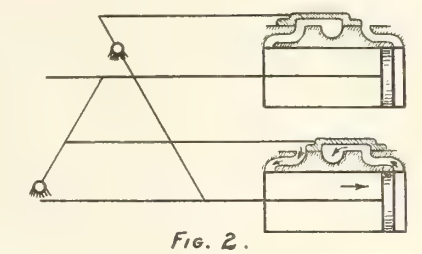


FIG. 2.

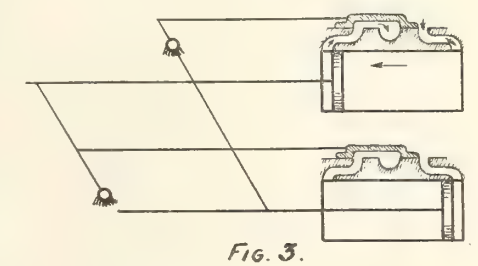


FIG. 3.

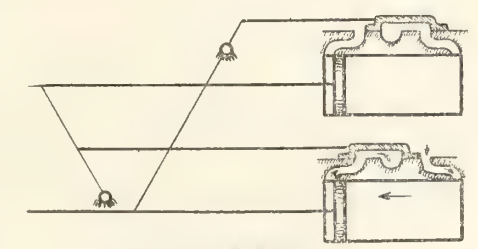


FIG. 4.

SETTING SIMPLE DUPLEX STEAM PUMP VALVES.

in Fig. 4, on examination of which it will be seen that the right piston tends to move toward the head end of its stroke, and, as it moves, it actuates the left valve; we then have the conditions that are shown in Fig. 1 and the whole cycle has been traced.

If the steam ends of the pump are compound, the same principles can be applied, as this factor really does not add to the difficulty of the problem.

PREVENTION OF SPARKING OF SMALL DYNAMOS.

By "Staveley."

WITH the increased use of dynamos and small direct current motors, the careful supervision of the commutator is an absolute necessity in the matters of economy and efficiency. Sparking at the brushes should not be tolerated, and the following suggestions will no doubt help in cases where the spark trouble is existing. Two conditions are necessary.

1.—The commutator must be in good condition.

2.—The brushes must be properly adjusted.

If the commutator is badly scored, or out of round, it should be taken to the lathe, trued up with very light cuts, and carefully polished with very fine emery cloth, all dust being carefully blown off. Smear the commutator with vaseline and then wipe off with dry duck, not with cotton waste. When the shaft has been replaced, all commutator connections should be examined to see that they are sound, and that the insulation is good.

The brush-holders can now be placed in position, having been previously cleaned and examined. The brushes should be inclined at an angle of about 60 degrees and the end of one brush should be wide enough to nearly cover two consecutive segments. There are several types of brushes now in use, but for many purposes a folded copper gauze brush is very suitable, it being light and flexible and, from necessity, must bear with light pressure on the commutator.

Now the position of the brushes is determined from the nature of the machine, that is, whether it be a two-pole-two-brush, four-pole-four-brush, or four-pole-two-brush. Suppose the commutator is made up of 80 segments, then mark one of these permanently as O. With a two-pole-two-brush machine, the positions of the brushes are primarily at 0 and 40, Fig. 2; with a four-pole-four-brush machine the positions are 0, 20, 40, and 60; and with a four-pole-two-brush machine the positions are 0 and 20, Figs. 3 and 4. These numbers can be marked permanently on segments where convenient.

Having now fixed in the brushes and bedded them nicely on the commutator, with light pressure, start up slowly and run for a while, wiping the commutator with dry duck if necessary. If commutator and brushes tend to bind at first, apply a very little vaseline to just lubricate. Now increase the speed, and if sparking occurs, adjust the rocker-arm, bearing in mind that for increased load, brushes go forward, and vice versa. If commutators and brushes be examined at stated intervals, say every week, and records be kept of the date when adjustments or renewals are made, of original maker's diameter of commutator, size of segments, insulation, etc., diameter when trued up, etc., breakdowns and burnouts will be greatly reduced. Further, and what is perhaps more important, you know in your private office whether the commutator trouble is with the man or with the machine when the current becomes erratic.

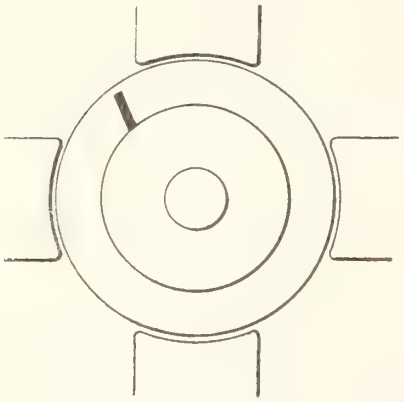


FIG. 1. ANGULAR POSITION OF BRUSH RELATIVE TO COMMUTATOR.

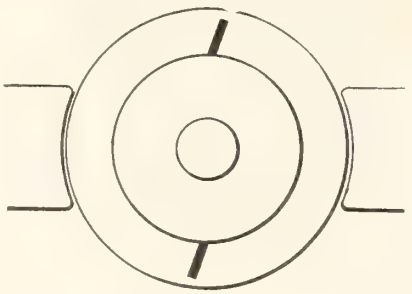


FIG. 2. POSITION OF BRUSHES FOR BI-POLAR MACHINE.

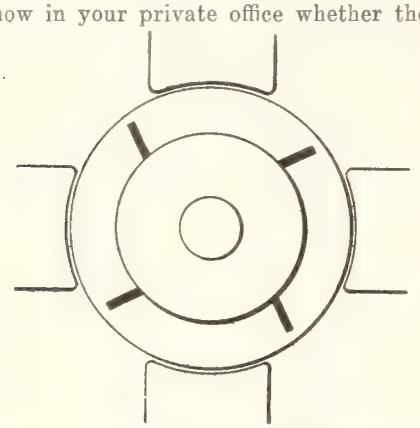


FIG. 3. FOUR-POLE FOUR-BRUSH ARRANGEMENT.

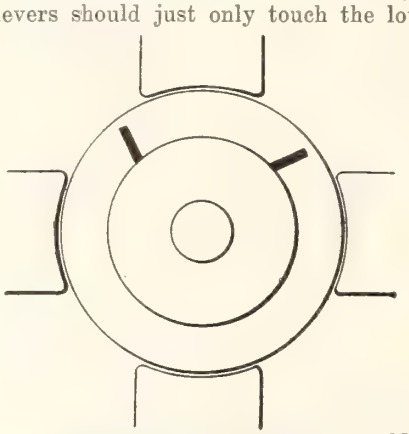


FIG. 4. BRUSH PLACING FOR FOUR-POLE TWO-BRUSH MACHINE.

SETTING "WEIR" STEAM PUMP VALVES.

By W. H.

AT first glance into the steam chest of a "Weir" steam valve, the various ports suggest a complicated motion, also trouble, and the problem of setting the valves looks to be a difficult one. Such is not the case, however, the work being simple indeed.

Fig. 1 represents the back of the main valve which forms the seat for the auxiliary valve. Fig. 2 represents the circular face of the main valve, and Fig. 3 the circular seat upon which it travels. Fig. 4 shows the auxiliary valve. The main valve should be placed so that the port C in Fig. 2 registers with the port C in Fig. 3. It will then be found that the port H nearest the live steam port C (Fig. 2) registers with the exhaust port H in Fig. 3. It will also be found that the port D (Fig. 3) registers with the port H nearest to port D in Fig. 2. The main valve is in this position with the piston on a slow downward stroke. When the piston is at mid-stroke, the little ball cross-head on the valve gear levers should just only touch the lower adjustable nut collars on the valve stem, and thus the auxiliary valve should start to move downward. When the piston has reached the bottom (frame) end of its stroke the top edge of the auxiliary valve should be just flush with the bottom edge of the port C (Fig. 1).

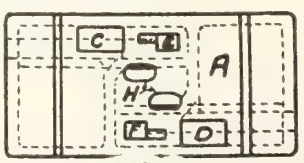


FIG. 1.

To see if the other events are properly timed, place the main valve so that the port D (Fig. 2) registers with the port D (Fig. 3). The exhaust port H nearest the live steam port D (Fig. 2) will register with exhaust port H (Fig. 3). It will also be found that the port C (Fig. 3) registers with the port H nearest to port C (Fig. 2). The valve is in this position as the piston is on a slow upward stroke. At half stroke again, the little ball cross-head on the valve gear levers ought to come up against the upper adjustable nut collars on the valve stem. On the piston reaching the upward (head) end of its stroke the lower edge of the auxiliary valve should be flush with the upper edge of the port D (Fig. 1).

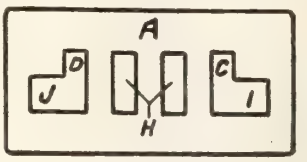


FIG. 2.

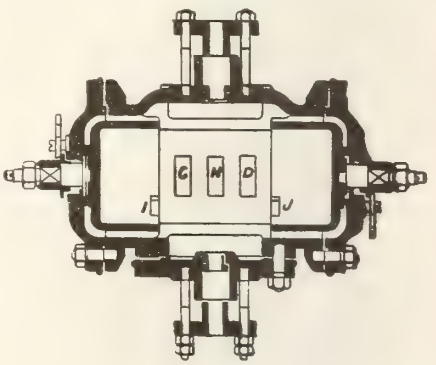


FIG. 3.

When these conditions prevail the remainder of the events will take care of themselves and the valves are properly set. However, care should be taken to have the auxiliary valve fit tightly against the main valve, and, if any slackness be noticed, a shim should be placed between the valve stem and the valve. The valve stem is square at that portion where the auxiliary valve is attached and the shimming is a simple job. After years of service it has been found that the main valves show no appreciable wear and thus need no attention.

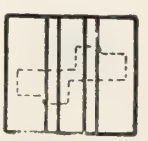


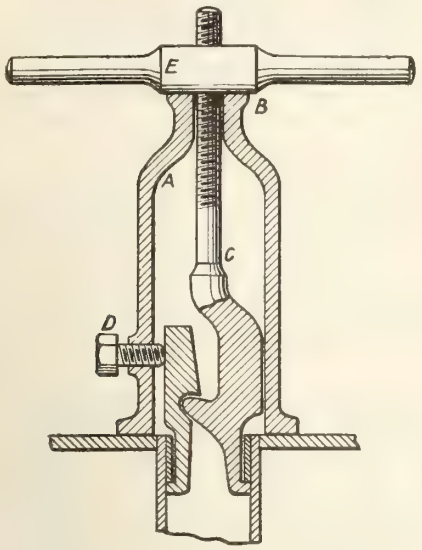
FIG. 4.

TOOL FOR DRAWING FERRULES FROM BOILER FLUES.

By Geo. Barrett.

THE illustration herewith shows a simple tool with a wide range of usefulness. It was made for the purpose of drawing

ferrules from boiler flues, but a cursory examination will suggest many other uses for the appliance. The body A is a steel casting or may be forged. It is drilled out at B to take the pulling screw



FERRULE PULLING APPLIANCE.

C which is forged to the shape shown and is screwed with a square thread.

The operation is self explanatory. The handle E is unscrewed to permit the dogs entering beyond the ferrule. The grip is made fast by screwing down the cap screw D. With a little judgment the apparatus can be made fairly light and the most refractory ferrule comes out by its aid very easily. The device can be improved for light work by putting a thumb screw in place of D and a spring around it between the loose dog and the frame.

AN ELEMENTARY STUDY OF RIVETED JOINTS.

RIVETING, at present, forms our only method of fastening steel plates together in the construction of steam boilers. The design of the riveted joint should be such as to secure the maximum aggregate strength. To accomplish this it should be equally strong in its several parts. That is, the shearing strength of the rivets should be equal to the tensile strength of the plate, and other possible methods of failure should be equally well balanced.

The rivets used in boiler work have, in general, two types of heads—the conical and round. The base of the former is usually made equal to twice the diameter of the rivet, and its height, three-quarters of the diameter. The base of the round head is made 1.7 times and the height 0.6 times the diameter. The distance from the centre of the rivet to the edge of the plate should be one and one-half times the rivet diameter, and the distance between centres of the rivets is known as the pitch.

Plates may be connected by lap joints or butt joints, and each may have one or several rows of rivets. A butt joint with a single cover plate should have the cover plate thickness equal to 1⅛ times the plate thickness. In the case of double butt straps, the thickness of each is made ⅝ of the thickness of the boiler shell. Longitudinal boiler seams are subjected to twice as great a stress as the ring seams, and hence have twice as many rows of rivets.

Riveted joints may fail in four separate ways: (1) The plate may fail in tension along the line of the rivets. (2) The rivets may fail by shearing. In the case of double cover plates this must take place at two points as the rivets are in double shear. (3) The rivet or the plate in front of the rivet may fail by crushing. (4) The plate in front of the rivet may shear out.

The **efficiency** of the joint is the strength of the joint compared to that of the unpunched plate. Thus, if the tensile strength of the plate is 64,000 pounds per square inch and a joint of ½-inch plate will stand 24,000 pounds per lineal inch, the efficiency of the

$$\text{joint is } \frac{24{,}000}{64{,}000} \times 2 = \frac{3}{4} = 75 \text{ per cent.}$$

This percentage can be greatly increased by increasing the pitch of the rivets and the number of rows.

• • •

Question.—What would be the shearing strength of a ¾-inch rivet?

Answer.—Cross sectional area of a ¾ rivet is $.75 \times .75 \times .7854 = .44179$ sq. inches.

Shearing strength of rivet steel is 50,000 pounds per square inch. Shearing strength of a ¾-inch rivet is then $.44179 \times 50{,}000 = 22{,}089$ pounds.

• • •

Question.—Using a safety factor of 6, and assuming the efficiency of the joint to be 65 per cent., what should be the thickness of a boiler shell plate for a boiler diameter of 54 inches and a steam pressure of 100 pounds per square inch?

Answer.—Total working pressure on one lineal inch of cross section is $54 \times 100 = 5{,}400$ pounds. This is resisted by two thicknesses of boiler plate. Ultimate tensile strength of boiler plate is 54,000 pounds per square inch. For a joint of 65 per cent. efficiency and a safety factor of 6, this becomes $\frac{54{,}000}{6}$

$$\times \frac{75}{100} = 6{,}750 \text{ pounds per sq. in.}$$

Load on a single thickness of plate 1 inch long $= \frac{5{,}400}{2} = 2{,}700$ pounds. Thickness of plate required $= \frac{27{,}000}{6{,}750} = .4$ inch, or, say, 7-16-inch plate.

• • •

Question.—What would be the approximate efficiency of a single riveted lap joint of good design, the pitch of the rivets being 4 inches and 1 inch rivets being used?

Answer.—It is assumed that the joint is equally strong in every way. The size of the hole punched in the plate will be 1 1-16 inch. In every 4 inches of length, 1 1-16 inch is punched out. Strength of plate after being punched is, therefore, 4—1 1-16.

$\frac{}{4}$ of the original plate.

$$\text{Efficiency, then, is } \frac{2\ 15\text{-}16}{4} = \frac{2.9375}{4} =$$

73.4 per cent.

• • •

Question.—In the above example, if ⅝-inch plate be used, would the joint fail by shearing off the rivets or tearing off the plate?

Answer.—Tensile strength of boiler steel is 54,000 pounds per sq. inch. The length of plate supported by one rivet is 4—1 1-16 = 2 15-16 in.

Cross sectional area of this is $\frac{5}{8} \times 2\ 15\text{-}16 = 1.835$ sq. in.

Total strength in tension $= 54{,}000 \times 1.875 = 101{,}250$ pounds.

Shearing strength of rivet steel = 50,000 pounds per sq. in. Shearing area of 1 inch rivet $= 1 \times 1 \times .7854 = .7854$ sq. in. Shearing strength of a 1 inch rivet is, therefore, $.7854 \times 50{,}000 = 39{,}270$ pounds.

The plating of the joint is then $\frac{101{,}250}{39{,}270}$ = 2.58 times as strong as the riveting. The joint is not well designed.

• • •

Question.—In the above problem what would be the effect of triple riveting and increasing the pitch from 4 to 6 inches?

Answer.—The length of unpunched plate per rivet in the front row = 6—1 1-16 = 4 15-16 inch.

The cross sectional area of this is $4\ 15\text{-}16 \times \frac{5}{8} = 3.08$ sq. in., and its tensile strength is $3.08 \times 54{,}000 = 166{,}320$ pounds.

This amount of plate is sustained by three rivets, the shearing strength of which is $.7854 \times 3 \times 50{,}000 = 117{,}810$ pounds.

The joint is still $\frac{166{,}320}{117{,}810} = 1.41$ times as strong through the plate as through the rivets.

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OUR SHIPPING INTERESTS AND THE WAR.

ALTHOUGH the annual statement of the Canada Steamship Lines shows a great falling-off in earnings from what had been anticipated, the actual figures correspond in most respects with those gleaned from earlier official and unofficial forecasts. The net earnings amounted to $928,000, being considerably less than half of those estimated.

It is unfortunate that no opportunity was had last year of testing out this gigantic combine of our Eastern Canada lake and ocean waterway shipping in what might be termed its maiden voyage. The European War intervened, and just to what extent it affected earnings is somewhat problematical. Lake and ocean waterway shipping for the present year gives every indication of being equally abnormal as 1914, if not more so, and we shall be pleasantly surprised if its record shows any very substantial improvement over the latter. The business disorganization arising from the War has become if anything more accentuated in the 'tween navigation seasons' period, and in the matter of passenger traffic during the coming months, there is every evidence that it will be largely curtailed, due to the rigid individual economy being practised.

War, with all its horrors and turmoil has, however, its compensations, and, a few of these, the Canada Steamship Lines may turn to profit. Sixteen vessels of its fleet are now under time charter for periods ranging from six months to one year, and due to the dearth of ocean waterway and ocean freight tonnage, good rates have been secured. This feature is a real advantage arising out of the War, and but for which would probably have led to the necessity of keeping many lake vessels laid up until the latter part of the season. A full, normal navigation season on the Lakes would not have been a prospect this year, war or no war, and the placing of so many vessels on charter on other routes ensures in large measure a fair chance of full time and full cargoes to those remaining in the lake sphere.

In another respect, a highly probable compensating effect of the War will be realized in the increased tourist traffic to our shores. Great Britain and Europe generally are to all intents and purposes out of the running this year so far as the thousands of globe-trotters who flock there annually are concerned. It is therefore not unreasonable to expect that a large percentage of such will make Canada their country of resort in 1915. Even making due allowance for those whom stress of circumstances will prohibit altogether from traveling, and for those—and they will be many, who will sacrifice their outing this year, in order to more comfortably and comprehensively visit the devastated territories and scenes of carnage and strife when the first available opportunity offers, there is sure to be in any case an abnormal influx of visitors who by the distribution of their substance will augment our passenger vessel earnings.

Reverting again to the freight carrying feature on our inland waters, the increased crop acreage under cultivation in the West will, with reasonable weather, mean considerably increased lake vessel transportation activities and probably increased rates due to the enhanced prices being received by the producers of foodstuffs for European consumption.

Taken all together and in spite of the abnormally crucial conditions prevailing, there is at least a sporting chance that our shipping receipts for season 1915 may make a reasonably fair showing. As we go to press, every indication points to a very early navigation season opening, and before our next issue appears the opportunity for vessel shipments from the head of our Lakes to the sea will be again with us. Our best wishes are for a year prosperous and free from disaster to the whole marine fraternity.

Marine News From Every Source

Toronto, Ont.—Hoping to get an early start this spring, steamboat owners have begun outfitting their steamers.

Oshawa, Ont.—In the Dominion Government estimates, $50,000 has been appropriated for harbor improvements here.

Sarnia, Ont—The G. T. R. has begun to dismantle the Northern Navigation wharf here and will erect a new structure about 800 feet long.

Quebec, Que.—It is announced that the work on the new dry-dock at St. Joseph de Levis will be recommenced as soon as the weather permits. Messrs. M. P. and J. T. Davis are the contractors for the work.

Halifax, N.S.—The Halifax Marine Engineering Co. has secured the contract for renewals and repairs to machinery piping and supply of boilers for the Canadian Government steamer Tyrian, at $16,750 and $9,200.

Victoria, B.C.—The Federal estimates for the current year contain large appropriations for both Victoria harbor improvements and the Esquimalt drydock. In the first instance, the sum is $1,400,000, and in respect to the drydock, the sum named is $250,000.

Ontario Wrecking & Construction Co. has been incorporated at Toronto, Ont., with a capital of $40,000 to carry on the business of all kinds of wrecking and building operations at Toronto, Ont. Incorporators: Maurice Goldstick, C. Lurie and B. Alexandroff, all of Toronto, Ont.

Navigation Season Opening.—It was announced on March 4, that the White Star Line running between Sarnia and Detroit would start its river service April 1. The Wauketa will be the first boat. The tug Fischer is the first steamer to open navigation at Sarnia, she having taken some machinery from there to Port Huron.

Collingwood, Ont.—The St. Lawrence & Chicago Steam Navigation Co. announces the following appointments of captains and engineers to its steamers: J. H. G. Hagarty—Capt. Samuel Hill, Chas. Robertson; E. B. Osler—Capt. C. E. Robinson, Wallace Robertson; W. D. Matthews — Capt. Wm. Cunningham, William Harwood; G. R. Crowe—Capt. J. H. Hudson, William Reid; Iroquois—Capt. D. A. Kennedy, Jas. E. Readman.

Ottawa, Ont.—Tenders will be received up to April 10, 1015, for the construction of a piled wharf in the Navy Yard at Halifax, N.S. Plans and specifications, together with the forms of tender and contract, may be seen at: (1) The Office of the Consulting Naval Engineer, Department of the Naval Service, Ottawa; (2) The Office of the captain in charge, H.M.C. Dockyard, Halifax, N.S.

Ban on Ship Transfers.—Transfers of Canadian registered ships to foreigners are prohibited by an Order-in-Council, now passed, unless such transfers are approved by the Minister of Marine on behalf of his Majesty. The prohibition applies during the continuance of the war and includes also the transfer of any share in the ownership of ships of Canadian or British register. The penalty for violation of this order is a fine of $5,000 or imprisonment for five years.

Fort William, Ont.—Crews of the following steamers which have been wintering in this port are now arriving to prepare their ships for 1915 navigation:—Agawa, A. E. Ames, Beaverton, E. D. Carter, Donnacona, Empress of Midland, Fordonian, Glenmavis, Grant Morden, Plummer, Rogers. The Donnacona and Empress of Midland, of the Canada Steamship Lines, will be fitted out for ocean trade service.

Vancouver, B C.—All attempts to float the Vancouver tug Sea Lion, which went ashore on a reef off Helen Point, Active Pass, have been so far unsuccessful, but word of the salving of the vessel is ultimately expected. Under the direction of Captain Bissett, of the Vancouver Dredging & Salvage Co., special launching ways have been built, and by this means it is anticipated the Sea Lion will be hauled from her high perch into deep water. She went on the rock at high tide, and is resting on her quarter to starboard. While engaged in attempting to salve the Sea Lion, the tug Alberni, owned by the Vancouver Dredging & Salvage Co., turned turtle in Active Pass and sank in deep water. The Alberni will be a total loss.

Fort William, Ont.—It is stated that the contract for the construction of two thousand feet of breakwater on the Mission river, Fort William, has been awarded to the Thunder Bay Contracting Co., and that work will be commenced on the new breakwater as soon as navigation opens. The cost of this work will be possibly in the neighborhood of a quarter of a million dollars, which forms part of the $1,200,000 in the Parliamentary estimates, for harbor improvements at the head of the lakes this year.

Algoma Central Steamship Co. — The Algoma Central Steamship Co. have made the following appointments of captains and engineers to their steamers for the ensuing year: Str. W. C. Franz—Captain W. C. Jordan, George Sylvester; Str. J. F. Taylor—Captain R. H. Boyle, L. R. Cronk; Str. Agawa—Captain J. A. Brown, J. L. Smith; Str. J. T. Drummond—Captain A. McIntyre, W. T. Rennie; Str. J. A. McKee—Captain H. C. Wingrove, John Knight; Str. Paliki — Captain R. J. Bassett, A. M. McInnes; Str. E. G. Carter—Captain C. H. Wilson, R. J. Sullivan.

Prince Rupert Drydock.—According to information given by G. T. P. officials, the new drydock at Prince Rupert will be completed in May, and ships will be docking there regularly next summer. G. T. P. vessels have, to the present, been going into drydock at Esquimalt. The new dock is designed to take vessels up to 25,000 tons, and will be the biggest on the coast with the possible exception of the one at San Francisco. It is being constructed with a view to trans-Pacific trade, and it will handle with ease two vessels the size of the Prince George or the Prince Rupert end to end.

Vancouver, B.C.—Tenders will be received up to March 31, for the supply of the following articles for the use of the B.C. dredging fleet at Vancouver, B.C., for 12 months ending March 31, 1916: Hardware; packings; Manila rope; wire rope; chain; steam pipe; valves and fittings; oils and greases; paint, paint oils, etc.; hose; brooms and

brushes; steel castings. Forms of tender may be obtained at the office of G. B. Hughes, district engineer, Victoria, B.C.; at the office of C. C. Worsfold, district engineer, New Westminster, B.C.; and at the office of J. L. Nelson, supt. of dredges, 614-18 Birks Building, Vancouver, B.C.

New Trial Granted.—A new trial has been awarded on the application of the C. P. R. from the judgment of Mr. Justice Britton, awarding James Richardson & Son, of Kingston $23,068.40. Richardson & Son shipped 90,000 bushels of oats from Fort William to Owen Sound by the Keewatin. Before the plaintiffs were notified of its arrival, it had been transferred into the C. P. R. elevator, which was destroyed by fire. The consignors claimed that they would have increased the $200,000 insurance they had on grain already in the elevator, if they had known of the arrival of the shipment. As it was, their loss ran into $228,098.45, much exceeding the insurance.

Ottawa, Ont.—Tenders will be received at this office until Wednesday, April 7, 1915, for the construction of one new chain of buckets, tumblers, together with spare parts, for dredge "Mastodon." Plans, specification and form of contract can be seen and forms of tender obtained at the Department of Public Works, Ottawa, and at the offices of A. Kastella, Esq., mechanical superintendent, Birks Building, Ottawa, Ont.; J. L. Nelson, Esq., supt. of dredges, Vancouver, B.C.; G. B. Hughes, Esq., district engineer, Victoria, B.C.; C. C. Worsfold, Esq., district engineer, New Westminster, B.C.; F. Y. Harcourt, Esq., district engineer, Port Arthur, Ont.; J. M. Wilson, Esq., acting district engineer, Toronto, Ont., and A. E. Dubuc, Esq., district engineer, Montreal, Que.

Water-borne Commerce Data. — The value of water-borne commerce of the United States carried under the American flag in the fiscal year 1914 was $368,360,000; under the British flag $2,023,340,000, and under the German flag $522,137,000, according to figures recently given out by U. S. Secretary of Commerce Redfield. For the period July to December, 1914, the proportion was as follows: American, $234,009,000; British, $872,581,000, and German, $50,803,000. Of the total for the first-named period, 9.26 per cent. was carried under the American flag; 53.45 per cent. under the British flag, and 13.70 per cent. under the German flag. In the second-named period, the percentage under the American flag increased to 14.09 per cent; that under the British flag decreased to 52.54 per cent., and that under the German flag decreased to 3.06 per cent.

THE SALVAGE OF SHIPS.

AT the recent annual general meeting of the Liverpool Salvage Association, James P. Rudolf, chairman, made an interesting report of the work of the year. He said that the cases dealt with by their wrecking plant had not been very numerous, but certain of them presented somewhat interesting features. Every case entrusted to them during the year had been brought to a successful issue.

Two of the more notable cases were the Gothland and the California. The Gothland, with a valuable cargo, struck on the Scilly Islands. The Linnet and the Ranger were promptly despatched. Within two days after the vessel stranded she was in a desperate position, practically the whole of the bottom forward having been torn away, and the heavy swell threatened to cause her to slip off the rocks, in which event she would undoubtedly have foundered.

Value of Compressed Air System.

Under these circumstances Captain Young decided to attempt to float the vessel as she was, and succeeded in bringing her into St. Mary's Bay, where she was beached. Air-compressors were installed, and the vessel was safely taken to Southampton. The value of the system of air compression is realized when a vessel of this tonnage is thus enabled safely to steam such a distance with extensive unrepaired damage. When the Association's steamers were at work on the Gothland the large Anchor Liner California ran ashore on Tory Island. After some two months of tedious and anxious work, that vessel was successfully floated, and placed in safety. For salvage work the Association give a choice of three bases—viz. (1)—Scale charges—that is to say, a fixed price per day for the hire of the steamers and plant; (2)—out-of-pocket expenses plus a bonus if successful; the third alternative is "no cure, no pay," which, of course, means nothing in the event of non-success.

Salving the "Gothland."

From the technical report of the salving of the Gothland, it appears that this vessel of 7,660 tons, on voyage from Montreal to Rotterdam, with grain cargo, stranded on Crim Rock, Scilly Isles, on June 23, 1914. The Linnet was despatched from Southampton, and the Ranger from Holyhead, on June 24, 1914. Divers reported 57 feet of the vessel's bottom under Nos. 1 and 2 holds absolutely gone, including ballast-tanks and shell-plating, the damage reaching to the top of the lower deck, and the forepeak gone to the 20-ft. mark. As the vessel was grinding heavily and slipping towards deep water, it was decided on June 25, 1914, to close up and secure all hatches with a view to floating, and, if possible, beaching the vessel in St. Mary's. This was successfully accomplished on June 27, 1914. Part of the cargo was then discharged. All forward holds were platformed, bulkheads secured, and five air-compressors, pumps, etc., placed in position. The vessel was re-floated on July 12, 1914, and left for Southampton via Falmouth, arriving safely at Southampton on July 13, 1914.

THE COMING ST. LAWRENCE SEASON.

WITH the bulk of the British merchant vessels doing duty with the fleet, it is naturally a subject of some discussion as to what ships will ply the St. Lawrence route during the rapidly approaching season. The so-called blockade by Germany's submarines does not seem to be worrying the steamship companies, for there is already a good-sized schedule prepared of vessels which will run between Quebec, Montreal and the British Isles carrying general freight and foodstuffs for England and her Allies.

Allan liners will make frequent trips and other lines will be represented in spite of the fact that so many vessels have been requisitioned by the Imperial Government. The White Star Company will be represented by the Northland, and in addition to that vessel there will doubtless be other arrangements to announce as the opening of the season approaches.

What Cunard Liners will run on the St. Lawrence route is still a matter of doubt, but three fixtures for the Donaldson Line have already been made by Robert Reford & Co. The Cassandra will sail from Montreal on May 8, the Athenia on June 12, and the Cassandra again on June 19.

The Head Line will give a regular ten-day service between Montreal and Belfast and Dublin. Among the boats which will ply on this route are the Torrhead, the Ramore Head, Inishowen Head, the Bray Head, and the Bengore Head.

There is also likely to be an adequate number of tramp steamers on hand at the opening of navigation.

Among the C. P. R. boats will be the Monmouth, Montreal, Ardgarroch, Mascara, Riotiete and the Milwaukee. It is expected that the Monteagle will also make her appearance in the St. Lawrence, as word has been received that the Imperial Government had released her from service. The first summer sailings of the Missanabie and Metagama will be as follows:—Metagama, May 7; Missanabie, May 21; Metagama, June 18.

Dominion Wreck Commission Investigations

Following the proceedings of a vessel stranding or collision inquiry is fascinating alike to the mariner and landsman. Much food for thought is always available, and in not a few instances it seems well nigh impossible to reconcile our conception of disaster prevention achievement when confronted with a detailed recital of the circumstances which contribute to many marine tragedies.

"MORWENNA"—"CHEBUCTO."

A FORMAL investigation into the causes which led to the collision between the s.s. Morwenna and the ferry steamer Chebucto, in Halifax Harbour, on the 20th day of January, 1915, before Captain L. A. Demers, F.R.A.S., F.R.S.A., Dominion Wreck Commissioner, assisted by Captain John Fleming and Captain John Hearn, acting as Nautical Assessors, was held at the Court House, Halifax, on Thursday, the 11th day of February, 1915, the court sitting until 11.30 p.m. in order to complete the hearing of evidence. Humphrey Mellish, K.C., appeared on behalf of the owners of the Morwenna and the master and officers of that vessel, while A. G. Morrison, K.C., appeared on behalf of the owners of the ferry and her master and mate.

Evidence of Morwenna Captain

The first witness examined was Captain Luke Holmes of the Morwenna, who holds a certificate of competency as master, No. 3,136, and who deposed that the Morwenna was a steel, single screw ship, of 856 tons net and 1505 tons gross, official No. 118.108. She carried a crew of 29, including three certificated officers besides himself, and three certificated engineers, and was capable of making 12 knots when light, in smooth water, and possibly 13 knots; her loaded draught was 17 ft. 5 in.

He left the wharf, pier No. 4, Halifax, at 5.25 p.m. on Saturday the 30th January last, and gave the order to go astern, and claims he backed out a distance of about 700 or 800 feet and then straightened up his course for a certain object on Georges Island, going at half speed, and the speed prior to the collision was between 6 and 7 knots. There was no regular course mentioned, but the vessel was steadied on a certain object, also not mentioned.

In the meantime he claimed that he saw the Dartmouth Ferry about a couple of points on his port bow, and, when he saw there was danger, he blew one blast of his whistle: but did not act according to the "rule of the road" pertaining to that signal; but kept his helm amidships. Shortly afterwards he ordered the engines to stop, then full speed astern, then stop, and at the time of the collision he claims he was going about 3 or 4 miles an hour through the water.

The Morwenna struck the Chebucto on her starboard quarter at right angles, inflicting damage more excessively felt by his vessel, the Morwenna. On the moment of impact, the Chebucto swung around to his starboard side and he heard an order from someone on the ferry to go full speed ahead, which he did, however, on his own account and dragged the ferry to near her place of destination.

At the time of the collision he assumed that he was some 300 feet from the wharves. He was on the bridge at the time of the collision and from the time he left the wharf. The third officer was on the bridge with him, executing his orders, the first officer being on the forecastle head on the look-out and watching the men coiling the ropes. The second officer was on look-out duty aft. The lights were lit before leaving the wharf, and at the time of the collision there was a strong wind from the northwest. This affected the ship under her stern propeller—which was right-handed—by swinging the bow to port. He knew that the Chebucto was the ferry boat, and also was aware of the place where she was to dock.

Evidence of Chebucto Captain.

The next witness examined was N. W. Allen, the captain of the ferry, who said he left the Dartmouth side of the harbour at about 5.30 p.m., or maybe a minute or two after as he was a little late, he thought. He went into the after wheelhouse—the ferry being a double-ender—to have his lunch and he never saw the Morwenna but heard the usual signal to the engine room to "stand by" and "easy," and when he came out the Morwenna was abaft the beam and the collision happened almost immediately.

When called upon to state why he was not at his proper station, he stated that it was usual for the masters of these ferries to have a bit of lunch at about that time, 5.30, when on the long shift from 1 p.m. to 1 a.m. They carry a mate fully certificated. The windows on the wheelhouse was clear at the time. There was a strong breeze, but not as strong as stated by the master of the Morwenna.

Evidence of Morwenna 3rd Officer.

The next witness examined was the third officer of the Morwenna, who holds an appropriate certificate. He said he was on the bridge with the master, and his instructions were to stand by the telegraph and execute all orders given by the master, which he did, as shown in the log. He saw the ferry about one point forward of the port beam, and there was a whistle blown—one blast—by his vessel, without an answer from the ferry.

He corroborated in many ways the statements of the master as to the movements of the telegraph and the orders he received and executed speedily, and which were as speedily carried out by the engineers. He estimated the distance from the wharf that his vessel had backed out as about 600 feet, and the distance off the wharves when the collision occurred was about a ship's length, 250 to 270 feet. He showed by rough diagram, exhibit 6, the position of vessels at moment of contact, which was at somewhat of an oblique angle to the stern, on the starboard quarter of the ferryboat. He heard someone on the ferry calling out to go full speed ahead, which was done by the master. Orders were given to have ropes thrown out and ladders made ready for the rescuing of passengers on the ferry; but it was unnecessary.

Evidence of Ferry Mate.

The mate of the ferry was the next witness, and he deposed that he took the wheel, as it was his duty to do, and shaped his course. He corroborated the statements made as to the weather conditions. He was in the wheelhouse and had a passenger with him, and there were two chairs in the wheelhouse. He said he never saw the Morwenna until his attention was called to her by the passenger who had been with him, but who had just left the wheelhouse when the "easy" bells were sounded. Immediately afterwards the collision happened and he claims the Morwenna struck at an oblique angle, but with very little shock. The windows were clear and of the five in the wheelhouse, the two in front were open. The others were clean, he having cleaned them before leaving Dartmouth. He refuted the idea that there was any frost on the windows, and said he could command a view all around, but did not see the Morwenna until his attention was called to her by the passenger. He said that notwithstanding the fact that there was on the wheelhouse door an inscription stating that no admission was allowed, he nevertheless allowed a passenger there and directed him to keep a look-out.

Other witnesses corroborated the statements already made to a certain extent, opinions differing considerably as to the strength of the wind that was blowing. The mate of the Morwenna contradicted the statements of the mas-

ter as to the distance the ship backed out from the wharf, he claiming it was 250 feet, or about one ship's length, otherwise he was very reticent in answering questions by the court and the counsel present.

The passenger of the Chebucto, Mitchell, stated he crossed frequently on that vessel, being a resident of Dartmouth working in Halifax, and very frequently went up in the wheelhouse travelling backwards and forwards; but, on this particular night, the mate had asked him to keep a good look-out. He was sitting on a box behind the mate, who was steering the vessel. He claims there was no conversation and due attention was paid to the steering of the ferry.

The chief engineer of the Morwenna stated that the entries in the log book were correct and that all orders were executed. The wheelsman and look-out of the Morwenna and Chebucto respectively did not throw any light on the collision.

Court Finding.

After giving full consideration to the more or less contradictory evidence submitted, the Court finding was that the master of the Morwenna, Luke Holmes, was alone at fault for the collision, and in consequence his certificate, No. 3,136, has been suspended for a period of six months from February 12, 1915, to August 12, 1915, without the option of a lower grade certificate being granted. The other officers of the Morwenna were exonerated from blame, as they did not participate as principals in the navigation of the vessel.

With regard to the Chebucto, the Court opinion was that the master, N. W. Allen, where a crew is limited, ought to be taking his lunch in the forward wheelhouse, where the navigation is conducted, instead of in the after wheelhouse, as he stated. Although there was no actual neglect of duty, he was reprimanded and cautioned to be more careful in the future.

With regard to the mate of the Chebucto, who was at the wheel, although holding that said vessel did not contribute to the collision, the court thought proper to suspend his certificate for one month, from February 12th to March 12th, 1915.

YARROWS, LTD., ACTIVITIES.

REPAIRS to the Dominion Government steamer Galiano was the largest contract undertaken by Yarrows, Ltd., at Esquimalt during the month of February. This vessel was seriously damaged early in the year when she went ashore at Coburg Spit, entrance to Esquimalt Harbor, after attempting to render assistance to the Norwegian barque Wulff, which dragged her anchors in the Royal Roads during a heavy gale. Yarrows, Ltd., secured the contract for repairs in competition with other British Columbia firms.

Extensive hull repairs were necessary, and called for the fitting of about sixteen new shell plates. The damaged floors and frames in the way of these plates were removed and repaired where necessary. The stern frame was removed, welded and straightened and returned, and a new rudder stock fitted. Her deck fittings were repaired and overhauled, and the propelling machinery also came in for a bit of attention, while the joiner work and decorations were gone over.

Early in the month the British freighter Strathdee was docked for cleaning and painting, and repairs were made to her rudder. The quarantine tender Madge was docked, cleaned and painted, a new propeller fitted, while sundry engine-room and deck repairs were also carried out.

A new condenser head was fitted aboard the C. P. R. triangular run steamer Princess Charlotte. The steamer Alaskan was docked, cleaned and painted, repairs being made to rudder and deck machinery, while her propeller was removed and replaced and a spare wheel shipped.

Minor repairs were carried out on the C. P. R. freighter Otter, which was also docked for cleaning and painting. The whaling tender Gray was docked, cleaned and painted, tail shaft drawn, stern gland repacked and rudder head rebushed. Engine repairs were effected on the steamer Storm King, and the collier Wellington was docked for cleaning and painting, and had her tail shaft drawn for inspection.

Department of the Naval Service.—Sealed tenders, addressed to the undersigned and endorsed "Tender for Patrol Service," will be received up to noon on Monday, April 5th, for the charter of several vessels for Patrol Service on the Eastern Coasts of Canada during the season of Summer navigation, 1915. Vessels offered should be of the Sea-going Tug or Trawler type, and from 125 to 175 feet long, speed 9 to 10 knots, and should be in good serviceable condition in all respects. Vessels fitted with trawler winches will receive prior consideration. Owners desiring to charter vessels conforming to the above description are requested to communicate full particulars and, if possible, plans of the vessels offered. The terms of charter are as follows: Owners to supply officers and crew, board, all stores and accept ordinary marine risk. Department to pay for fuel and carry War Risk. D. J. Desbarats, Deputy Minister of the Naval Service, Ottawa, Ont.

GOVERNMENT CRAFT FITTING OUT.

NECESSARY repairs to the fleet of steamers under the Montreal Agency of the Department of Marine and Fisheries, which have been in winter quarters at Sorel since last fall, are now being rushed to completion in order that the vessels will be ready to go into active commission on or about April 1. The usual winter work of repairing and making new buoys is just about completed.

The Department has now under way the completion of the new light at Lavaltrie, to be ready for the opening of navigation. This light was constructed to serve as a new back light for the Lavaltrie Range, and the present back light will replace the old front light, which will be discontinued. The new light will be a considerable improvement on the old one, consisting of a high-level pier constructed of concrete and surmounted by a steel tower.

New lights of an improved type are also being constructed at Melocheville. The lake carriers navigating that part of Lake St. Louis will benefit from the more powerful light apparatus being constructed. Work will start as soon as possible after the opening of navigation to finish the lights at the north end of the lake, which were partly constructed last fall.

In the month of February, the Department removed what would have been a serious menace to navigation by demolishing the Rhoda, which ran aground between Victoria bridge and Laprairie last summer, and was abandoned by the owners. It was necessary that this steamer should be removed before the opening of navigation, as the whole or part of the vessel might have been carried down by the ice in the spring and prove a grave danger to the vessels coming into Montreal harbor. A short time ago it was reported that efforts were being made to salve the vessel by dredging and blasting out the sand. This, however, was not the case, as it would have been impossible to save the vessel in the position in which she lay. The Department workers approached the vessel over the ice. The machinery was removed first, the upper part of the hull burned to the water's edge, and the remainder entirely demolished by the use of large quantities of dynamite.

As soon as the Dollard and Shamrock are ready, the laying of the buoys will commence. In this work, as well as in the picking up of the buoys in the fall, the buoy boats are aided by several tugs and scows from the ship channel branch of the Department.

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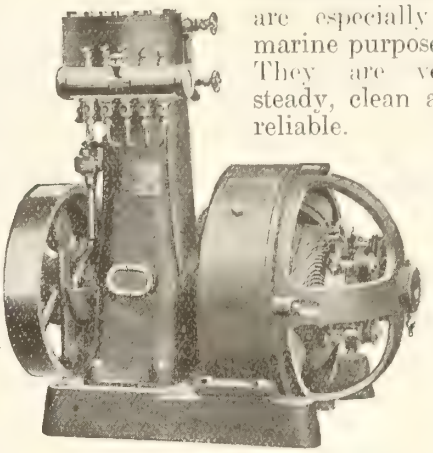

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ASSOCIATION AND PERSONAL

A Monthly Record of Current Association News and of Individuals Who Have Been More or Less Prominent in Marine Circles

Sir Trevor Dawson, managing director of Vickers, Ltd., is visiting Canada, and is the guest of Sir Frederick and Lady Williams-Taylor at Montreal.

Captain Murdock McLean, of Duluth, died Thursday, March 4, of heart trouble. He was born in Kincardine, Ont., 60 years ago and spent most of his marine career in Canadian fleets.

Captain John McMulkin, for many years one of the best known St. John river steamer captains, for ten years an alderman in St. John, and New Brunswick's first factory inspector, died on Feb. 24, aged 79 years.

Captain Hugh McKinnon died at Kincardine, Ont., on March 25, following an operation. Deceased, who was 69 years of age, was one of the best known sailors on the Great Lakes, having for over forty years commanded sailing vessels on them.

William Newman, naval architect of the Polson Iron Works, Toronto, has been awarded a commission with the rank of lieutenant in the 23rd Regiment Northern Pioneers, Owen Sound, his home town. He was formerly a non-commissioned officer in the 48th Highlanders and the 14th Princess of Wales' Own Rifles, Kingston.

Capt. J. W Hatherly of the Allan liner Mongolian, was killed on March 17, when a hatch beam struck him. The Mongolian was undergoing repairs in drydock. Capt. Hatherly was 48 years of age, and leaves a widow and two children in Glasgow. He has been on the Mongolian two years, and sailed between British ports and Philadelphia.

SHIPPING FEDERATION OFFICERS

THE officers who will preside over the Shipping Federation for the ensuing year are:—

Andrew A. Allan, president; J. R. Binning, treasurer; E. W. Foulds, assistant treasurer.

Executive Council—Andrew A. Allan, J. R. Binning, D. W. Campbell, A. Mackenzie, W. R. Eakin, R. W. Redford, John Torrance.

The following representatives of the respective steamship lines were elected:—Allan Line, Andrew A. Allan and W. A. Wainwright; White Star-Dominion, Canada and Cie Generale Transatlantique Lines, John Torrance, P. V. G. Mitchell and W. Macpherson; Cunard, Donaldson, Thomson and Cairn Lines, R. W. Redford and W. I. Gear; Manchester and Furness Lines, J. R. Binning and J. W. Nicoll; New Zealand Shipping Co. Line, E. W. Foulds and V. A. Ward; Elder, Dempster & Co., D. W. Campbell; Canadian Northern Steamship Lines, R. C. Vaughan and Guy Tombs; Head Line, W. R. Eakin and A. E. Francis; Dominion Coal Co., A. Mackenzie and A. Dick; Nova Scotia Steel & Coal Co., Lorne C. Webster.

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Captain Walter Collins, 43 Main Street, Kingston, Ont.; Captain M. McDonald, River Hotel, Kingston, Ont.; Captain Charles J. Martin, 13 Balaclava Street, Kingston, Ont.; Captain T. J. Murphy, 11 William Street, Kingston, Ont.

ST. LAWRENCE RIVER, BAY OF QUINTE, AND MURRAY CANAL.

Captain James Murray, 106 Clergy Street, Kingston, Ont.; Capt. James H. Martin, 259 Johnston Street, Kingston, Ont.; John Corkery, 17 Rideau Street, Kingston, Ont.; Captain Daniel H. Mills, 272 University Avenue, Kingston, Ont.

ASSOCIATIONS

DOMINION MARINE ASSOCIATION.

President—A. E. Mathews, Toronto. **Counsel**—F. King, Kingston, Ont.

GREAT LAKES AND ST. LAWRENCE RIVER RATE COMMITTEE.

Chairman—W. F. Herman, Cleveland, Ohio. Secretary—Jas. Morrison, Montreal.

INTERNATIONAL WATER LINES PASSENGER ASSOCIATION.

President—O. H. Taylor, New York.
Secretary—M. R. Nelson, 1184 Broadway, New York.

THE SHIPPING FEDERATION OF CANADA

President—Andrew A. Allan, Montreal; **Manager and Secretary**—T. Robb, 218 Board of Trade, Montreal; **Treasurer**, J. R. Binning, Montreal.

GRAND COUNCIL, N.A.M.E. OFFICERS.

L. B. Cronk, Windsor, Ont., Grand President.
A. F. Hamelin, Montreal, Que., Grand Vice-President.

Neil J. Morrison, P. O. Box 238, St. John, N.B., Grand Secretary-Treasurer.

E. Read, Vancouver, B.C., Grand Conductor.

A. J. Ross, Halifax, N.S., Grand Doorkeeper.

James Gillie and A. E. Kennedy, Kingston, Ont., Grand Auditors

SUBORDINATE COUNCIL ELECTIONS, N A. M. E.

ELECTIONS of officers of subordinate councils, National Association of Marine Engineers, took place recently as follows:

Vancouver, No. 7.—President, W. G. Wooster; 1st vice-president, John I. Marshall; 2nd vice-president, J. Johnston; secretary-treasurer, E. Read; conductor, Adam Forbes; doorkeeper, W. J. White; auditors, A. H. Evans and John I. Marshall.

Twin City, No. 16.—President, Harry Cross; 1st vice-president, Bert Debenhardy; 2nd vice-president, James Bennett; secretary, Lloyd Williams; assistant secretary, Bert Nelson; treasurer, Charles Saunders; doorkeeper, M. Currie; conductor, J. B. Hawkins; corresponding secretary, W. R. Sweet; finance committee, J. Nelson, M. Cosgrave, Charles Saunders; audit committee, H. Debenhardy and James Bennett.

1915 Directory of Subordinate Councils, National Association of Marine Engineers.

Name.	No.	President.	Address.	Secretary.	Address.
Toronto,	1	Chas. M. Arnott.	94 Hurley Street.	J. S. Adams	631 Gladstone Ave., Toronto.
St. John,	2	G. J. McVicar	49 Winslow St. West.	G. T. G. Blewett.	36 Murray St., St. John, N.B.
Collingwood,	3	W. T. Rennie,	Collingwood.	Robert McQuade,	P. O. Box 97, Collingwood.
Kingston,	4	E. Spence	Kingston	James Gillie,	101 Clergy St., Kingston, Ont.
Montreal,	5	A. F. Hamelin,	3210 Le Tang Street,	O. L. Marchand,	2378 Clark St., St. Vincent de Paul, P.Q.
Victoria,	6	John E. Jeffcott,	Esquimault.	Peter Gordon,	808 Blanchard St., Victoria, B.C.
Vancouver,	7	W. G. Wooster,		E. Read,	Room 8, Jones Bldg., Vancouver, B.C.
Levis,	8	Michael Latulippe,	Lauzon,	S. G. Guenard,	Bienville, Levis, P.Q.
Sorel,	9	John Matte,	Sorel,	Al. Charbonneau,	P. O. Box 132, Sorel, P.Qa.
Owen Sound,	10	Wallace Robertson,	1030 4th Ave. West,	James Nicoll,	714 4th Ave., Owen Sound, Ont.
Windsor,	11	Alex McDonald,	28 Crawford Ave.	Neil Maitland,	221 London St., W., Windsor, Ont.
Midland,	12	George Wilson	Midland,	Roy N. Smith	
Halifax,	13	Robt. Blair,	29 Preston Street,	Chas. E. Pearce,	Portland St., Dartmouth, N.S.
Sault Ste. Marie	14	A. E. Lewis,	Box 563, Soo, Ont.,	Geo. S. Biggar,	43 Grosvenor Ave., Sault Ste Marie.
Charlottetown,	15	J. F. McGuigan,	38 Queen Street,	Lem Winchester,	302 Fitzroy St., Charlottetown, P.E.I.
Twin City,	16	Harry Cross,		Lloyd Williams,	142 Secord St., Fort William, Ont.

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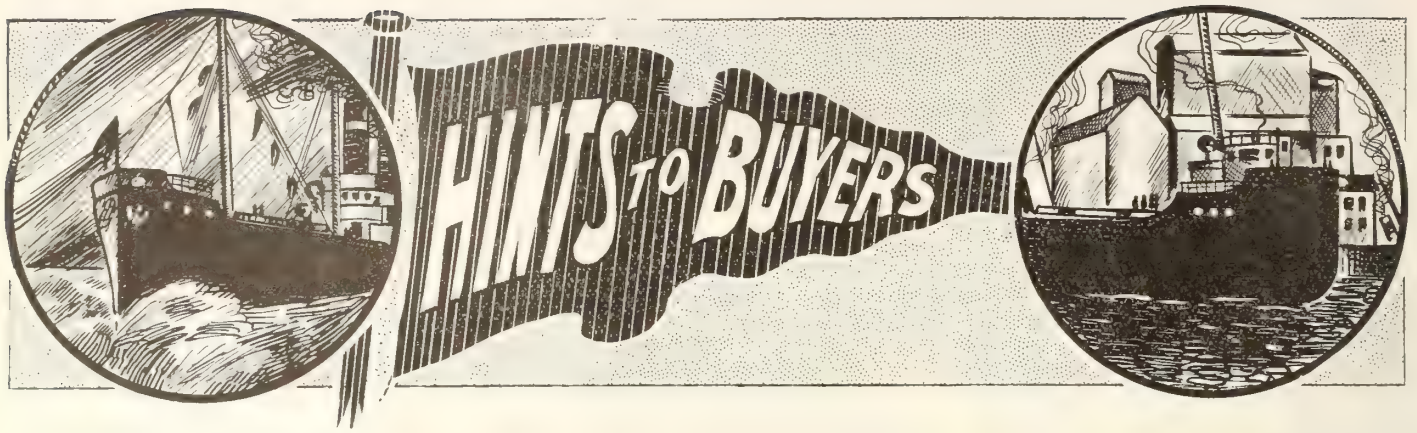

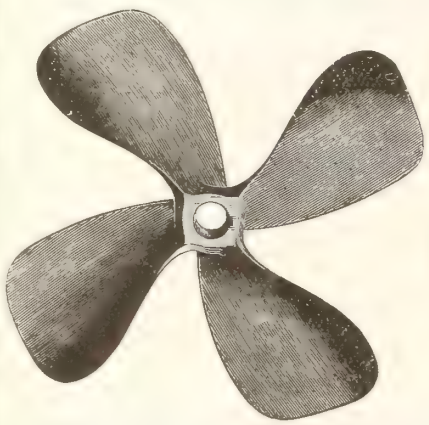

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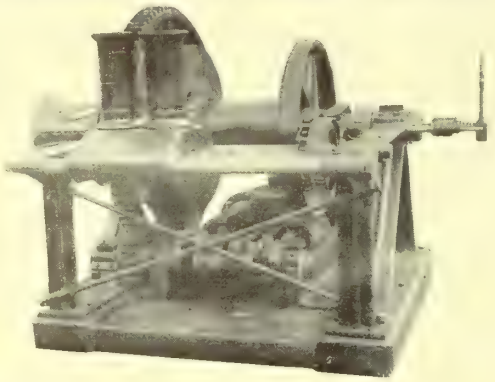

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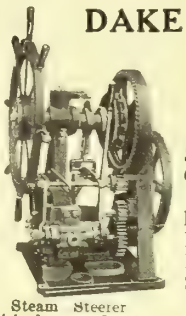

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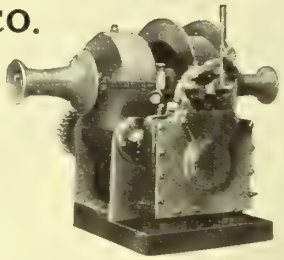

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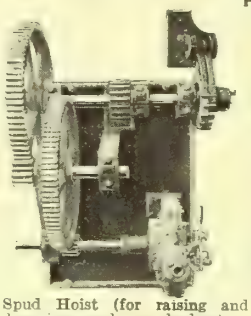

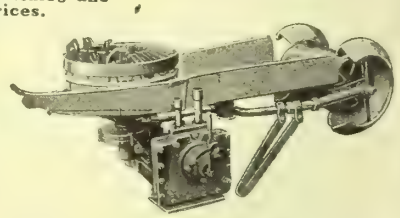

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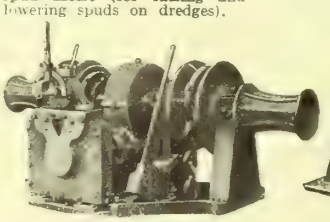

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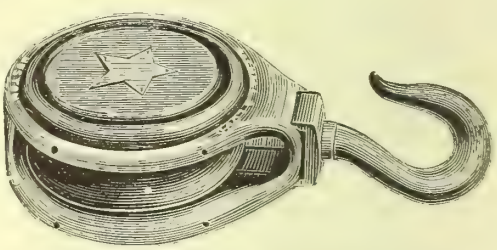

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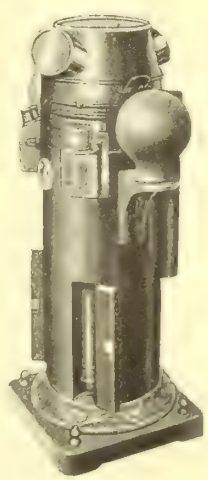

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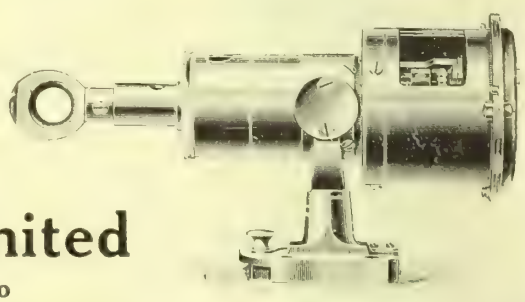

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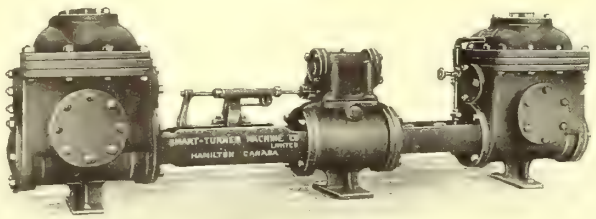

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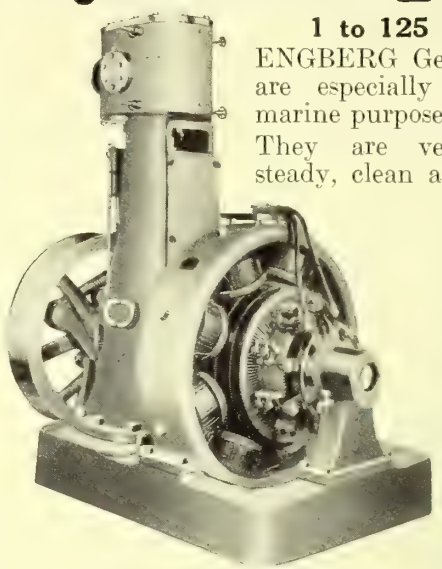

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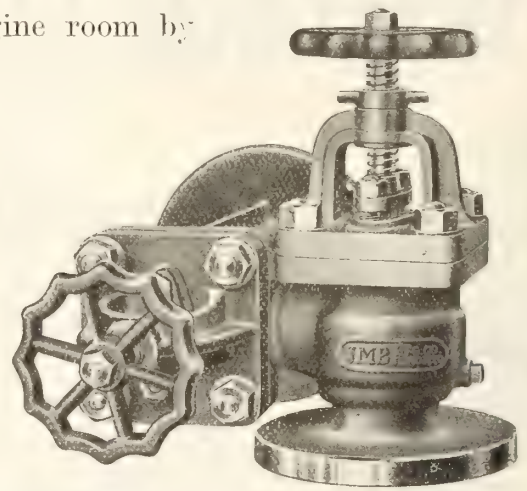

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Made from best steam metal. Regrinding renewable seats. Set Screws prevent seats coming loose in body, while recessed spigoted joint between yoke and body prevents packing blowing out.

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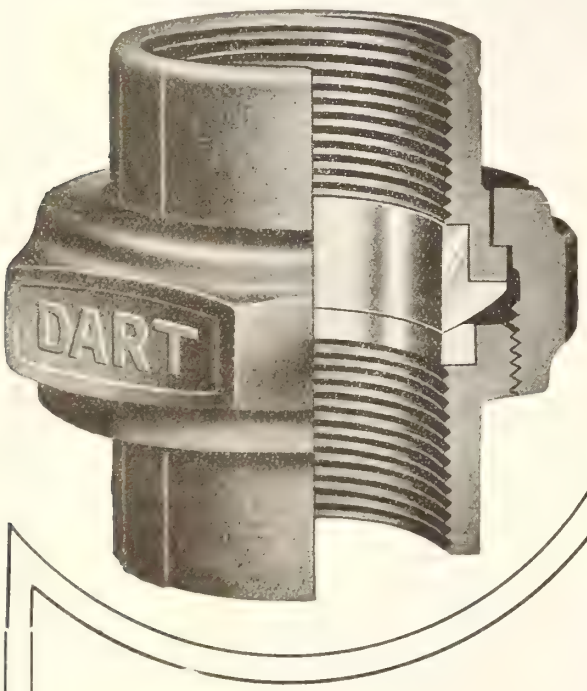

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BOTH FACES ARE BRONZE

Sold by jobbers at every port.

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Effect of Unloading Appliances on Ore Carrier Design*

By John Reid **

To take full advantage of the short season of navigation available on our Lakes, it becomes necessary to reduce each vessel's stay in any port to the absolute minimum, and this is secured by having the most modern, rapid and reliable loading and unloading equipment installed there. The modification of vessel design as a contributory factor may be taken as the essence of the author's observations and ideas here given expresson to.

AMONG the very varied problems of marine transportation, those relating to the movement of bulk cargoes of coal and iron ore fall naturally into a class by themselves. These cargoes are peculiar by reason of the enormous quantities shipped, the considerable distances which have to be negotiated, and the expeditious methods of handling in loading and discharging which their comparative indestructibility permits. It is, moreover, of paramount importance to the world's industries that the transportation charges on such cargoes should be reduced to a minimum; in other words, that the methods employed in their transportation should possess the maximum of efficiency and economy, not only in their movement by water, but also by railroad, in the loading and unloading of the ships and trucks, and in the storage and re-handling arrangements at the docks and furnaces.

In this last respect it is recognized that operators are frequently heavily handicapped by reason of the backwardness of railroads, the smallness of the vessels employed in the work, the primitive nature of the loading and unloading appliances, and the inadequate storage facilities at all stages of the journey from mines to furnaces. I speak more particularly of iron ore shipped to Great Britain from many foreign countries, in the handling of which she is still far behind the Continent, and still further behind the United States, in her methods.

U.S. Transportation Methods.

In 1899 and following years, the author was called upon to investigate American methods of transporting iron ore from the mines to the furnaces with a view to adapting these methods, where suitable, to English practice. It is well known that the principal traffic route for iron ore in the United States is from Duluth and the neighboring ports at the head of Lake Superior to Cleveland, Conneaut, Ashtabula and other Lake Erie ports convenient to the Pittsburg group of furnaces. The shipment of ore over this route in one year has reached the enormous total of nearly 50,000,000 tons, the season of open lake navigation lasting only for seven months. It would be natural with such a movement of material in bulk to expect to find remarkable methods of mining and transportation in use; and such is indeed the case.

Whether at the mines, on the railroad

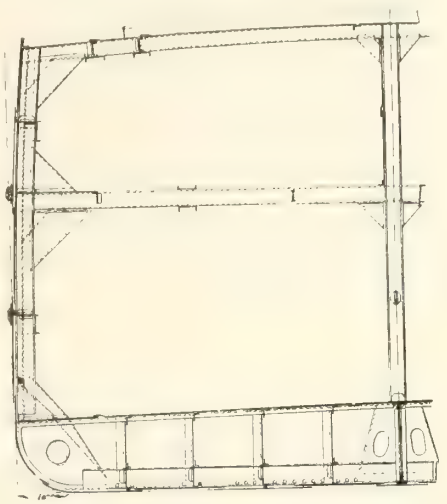


FIG. 1. MIDSHIP SECTION, BULK FREIGHT STEAMER. LENGTH, 450 FT.; BREADTH, 50 FT.; DEPTH, 28 FT. 6 INS.

or on shipboard, whether we consider the size of the locomotives and the train weights moved, the shipping piers, the ships themselves, the unloading appliances, the storage facilities at docks and furnaces, United States' methods of handling iron ore are all on a colossal scale, which has to be seen to be appreciated. It is safe to say that nowhere else is transportation of bulk cargo reduced to such a perfect system or carried on with a like degree of efficiency and economy. It is my purpose to describe briefly the development of the ore steamer of the Great Lakes, and to show how some of its leading features may be adapted with advantage for the ocean-going ore carriers now under consideration as a result of the world-wide range of the ore operators, who seem to be as much concerned to find new sources from which to draw their supplies as are dealers in oil, coal, grain and other staples

Vessel Design Adaptation.

It is particularly important to note the influence in the design of the large ore steamers of the present day which such extraneous matters as the nature of the loading and discharging appliances have undoubtedly had. In 1899, on the occasion of my first visit to the United States, the largest vessels employed in the ore trade were of about 8,000 tons deadweight, of the ordinary single-deck design with the familiar lay-out of the lake type of steamer, viz., engines aft, navigating quarters forward, flush decks clear of erections all fore and aft, numerous short but very broad

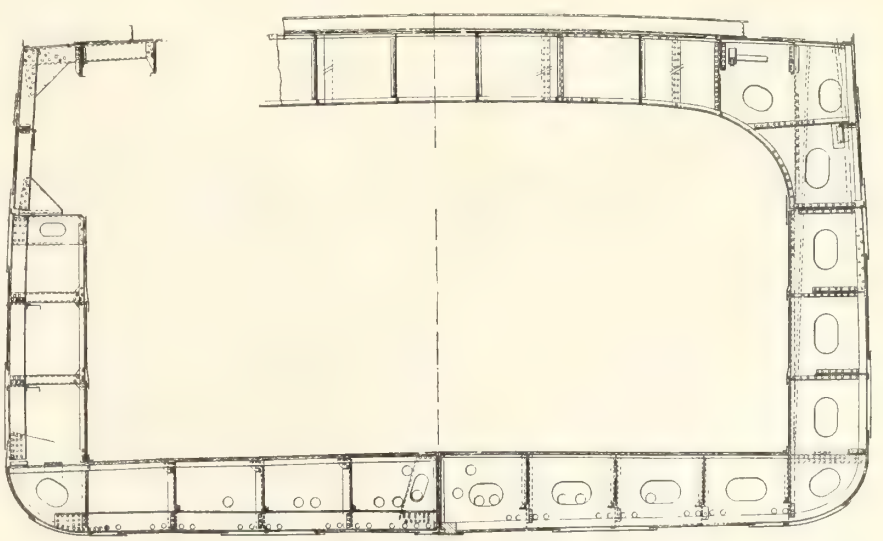


FIG. 2. MIDSHIP SECTION, BULK FREIGHT STEAMER. LENGTH 550 FT., BREADTH 56 FT., DEPTH 31 FT.

hatches, spaced 24 ft. centres—to suit the loading spouts on the ore piers—and with centre pillars of channel section, and numerous through hold beams and

*From a recent paper before the Institution of Naval Architects, Great Britain.
**Consulting Naval Architect, Glasgow and Montreal.

deep stringers. It was common in those days on the Lakes for the steamer to tow a barge of about the same size and deadweight as itself, a steam towing engine of very ingenious construction being used to prevent sudden snapping strains coming on the tow hawser. Fig. 1 shows the midship section of this type vessel.

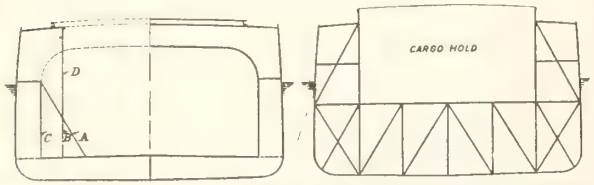


FIG. 3. ARRANGEMENTS OF HOPPER HOLDS. FIG. 4. INCREASED DOUBLE BOTTOM DEPTH SCHEME.

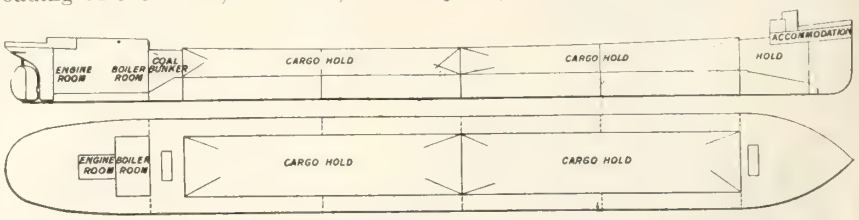


FIG. 5. LAKE TYPE OF ORE CARRIER WITH RAISED HOPPER HOLDS. LENGTH, 550 FT.; BREADTH, 65 FT.; DEPTH, 33 FT.

Owing to the shortness of the open season, it is, of course, most important to eliminate as far as possible all delay of the steamships at terminal ports. To load a 10,000 or 12,000-ton ore carrier at the Lake Superior ore docks in four or five hours, and discharge it at the Lake Erie terminal in less time, is a common occurrence during the season. This presupposes the storage of the whole cargo of Superior ores, being of a consistency similar to dry earth or sand, lend themselves to this method of handling. When the ore is of a coarser nature grinding is resorted to, so that the shipping arrangements may not be interfered with.

The unloading of the ore is, of course, a much more serious problem, but it has been brilliantly solved by the Hulett and other machines, now in common use at all the great terminal ports of Lake Erie, and also at the storage piers at the furnaces at Pittsburg and other steel centres. There are, of course, many different types of unloading apparatus adapted to the discharge of ore and coal cargoes, but I have chosen for my purpose the vessels on which it is engaged. It will be understood that the following description refers only to work on the Great Lakes of North America. There are indications, however, that these machines will shortly be brought into use at tidewater ports, but at present the conditions in the ocean-borne ore trade prohibit their introduction.

Hulett Ore Unloader Description.

The Hulett ore-unloader was first introduced at Conneaut (Ohio), at the new Carnegie ore docks in 1899. The author happened to be present at the tests of the first machine, which, considering its revolutionary nature and the fact that

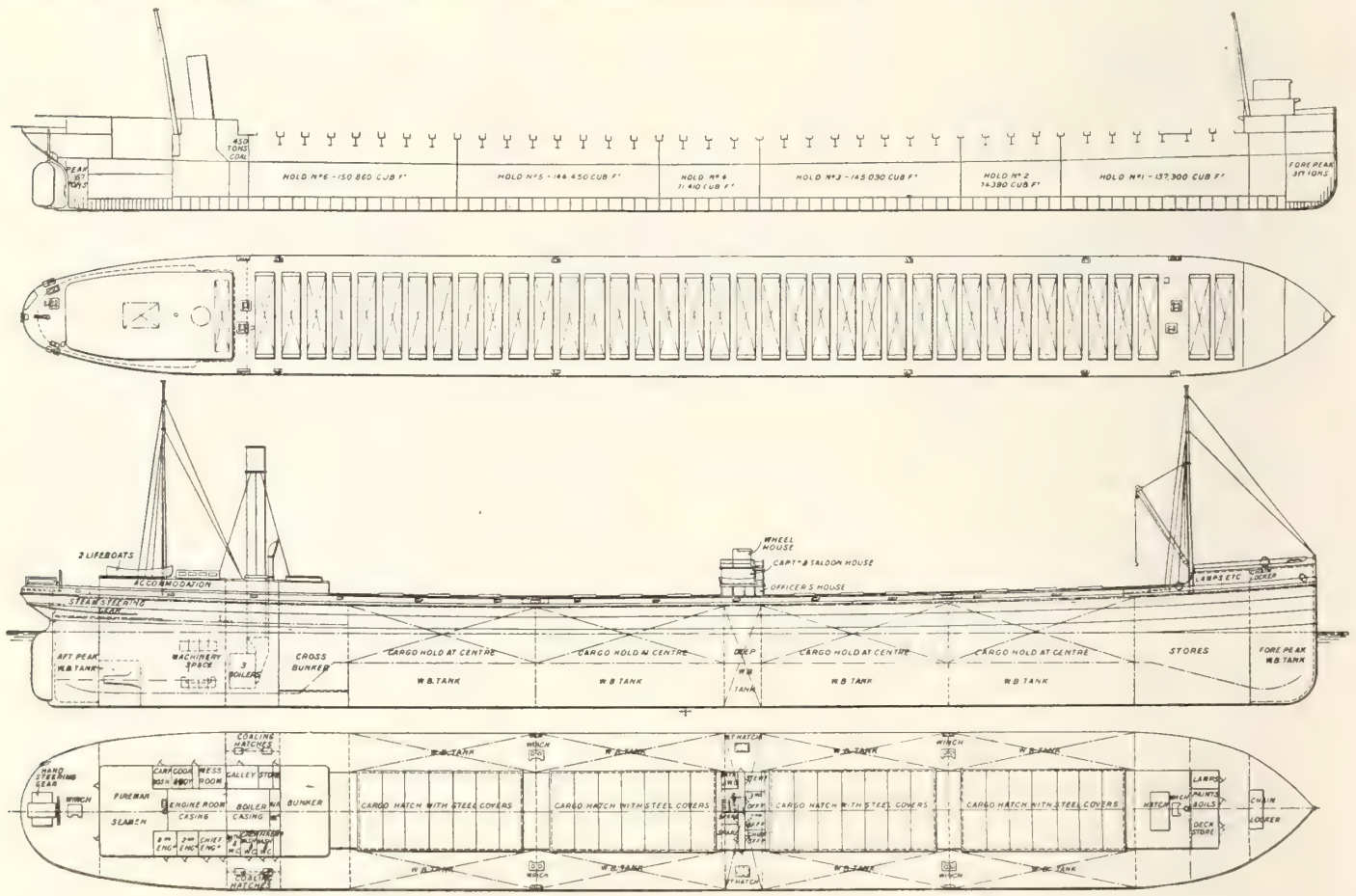


FIG. 6. UPPER, SHOWS STEAMER "W. GRANT MORDEN," OF LENGTH, O.A., 625 FT.; LENGTH, B.P., 604 FT.; BREADTH MOLDED, 59 FT.; DEPTH MOLDED, 32 FT.

FIG. 7. LOWER, SHOWS OCEAN TYPE ORE CARRYING STEAMER, OF LENGTH, 540 FT.; BREADTH, 66 FT.; DEPTH, 42 FT. MOLDED; AND 16,000 TONS ON 30 FT. DRAFT.

ore in pockets on the loading piers, all ready to be shot into the vessel the moment it is moored alongside. It should be noted that the majority of the Lake Hulett unloader, because it has been conceived on a truly heroic scale, and because its introduction has had a very noticeable effect on the design of the it was operating on a vessel quite unsuited to up-to-date methods of ore-handling, were very successful. The immediate result was a drop in unloading costs of ore

from 19 cents a ton, with the best previous appliances, to 6 cents with the Hulett machine. Naturally, with the enormous scope in the lake trade for such appliances, the development of this mechanism was very rapid. Among the latest outfits have been those supplied to the Pennsylvania Co. and the Canadian Pacific Railway. The following description refers to the former only.

The ground plan includes a storage yard of 50 acres, with a concrete dock wall 800 feet long, providing a storage space for 1,000,000 tons of ore. There are four unloaders, each carrying a 17-ton bucket. The unloaders span four railway tracks, and a cantilever rearward extension enables them to discharge the ore 116 feet in from the face of the dock. The maximum outreach when the reciprocating bucket arm is lowered into a vessel is 65 ft. from the face of the dock. In order to distribute the ore over the storage area there is a travelling gantry-crane operating behind the unloaders, with a main span of 266 ft., and a cantilever at each end of 170 ft.

Hulett Unloader Operation.

The method of operations is as follows:—The ore in the vessel's hold is first grabbed by the 17-ton bucket, elevated by the rocking arm, run in over a 60-ton receiving hopper on the main frame of the machine, into which it is discharged. From the hopper the ore passes into a 50-ton traveler and scale car, from which finally it passes into railway cars on any or either of the four tracks, or into the temporary storage pile under the cantilever extension, from which the bridge conveyor handles it to the main storage pile. It will be sufficient to give an idea of the scale of the Hulett unloader if I state that the 17-ton bucket shells, when open, have an extension of 21 ft. 3 in., and a telescopic motion of 3 ft. A complete cycle of operations for the bucket takes 50 seconds, which points to a discharge capacity of 1,000 tons per hour or 4,000 tons per hour for the four machines. Of course, this rate is difficult to maintain under all conditions, but 10,000-ton cargoes of ore have been unloaded on the lakes by these appliances and their accessories in less than three hours.

Hopper Hold Vessel Feature.

I have already referred to the unsuitable nature of the vessels on which the first trials of the Hulett unloader were conducted. Tank tops, cross beams and webs are all liable to severe damage, and the necessity for extra care in using the unloader in vessels of this type reduces the speed of operation and prejudices the efficiency and economy of the unloading appliances. It becomes imperative, therefore, to consider the improvement of the vessel so as to adjust its interior arrangements to suit this most important development in discharging appliances, and on full consideration I recommended the introduction of a hopper or interior hold formed by carrying two parallel longitudinal vertical bulkheads from the tank top to the upper deck, the wing spaces being utilized for water ballast. It was further proposed to remove all deck plating from between these longitudinal bulkheads, and to tie the ship together by wide spaced heavy arch beams, and to fit portable webs and steel hatch covers for the protection of ship and cargo.

It should be remembered that one had under consideration the design of a comparatively deep-draught vessel for the English ore trade to be unloaded by very much more primitive apparatus, but the improvements in ore-carrying vessels to be anticipated by a study of the Great Lakes methods seemed to point to important possibilities also in English practice. During visits to the United States in the years immediately following the introduction of the Hulett machine, its effect on the development of the ore vessels was quickly noted, and in 1904 was launched one of the first lake vessels to embody the features above referred to.

It was not found desirable in lake practice to carry the hopper holds to the upper deck. To have done so would have been to cut off so much of the available hold space as to prohibit the use of these vessels for coal and grain—too serious a drawback for the average owner, to offset the advantages for ore cargoes. Therefore, after various experiments in the construction of these hopper holds a fairly definite type was evolved, containing the parallel sidewalls and arch beams, and indicated in the midship section plan in Fig. 2. The diagram, Fig. 3, is drawn to show the process of evolution, the hopper forms marked A, B, C, indicating in order the various arrangements of hopper holds adopted. In some recent cases the hopper walls are continued right up to the upper deck, as shown in D.

It will be evident that a vessel of this standard lake type, with its double-bottom and hopper wing spaces terminating at the level of the main deck stringer, has a distribution of scantlings in its midship section which, as regards longitudinal structural girder value, somewhat neglects the top sides. Owing to the wide, close-spaced hatches, the shallow moulded depth relative to the length, and the lack of longitudinal bracing in way of the fore-and-aft hatch limits, the top side strength is still further prejudiced. There are not wanting evidences of a tendency in recent designs to return to a more favorable disposition of the available material. Hatches are now frequently 24-ft. centres, with 12 ft. deck areas between, and efforts are being made, by the adoption of longitudinal framing and longitudinal top side girders above the hopper holds, to return to a more wholesome type, one of the latest and largest of which is shown in Fig. 6. Towards this, the adoption of continuous longitudinal vertical bulkheads, forming the hopper holds above described, would materially contribute. A further step in ore carrier design is now impending, which will greatly improve the type and facilitate its discharge.

Specialized Ore Carrier Design.

In cases where large vessels are to be built exclusively for the transport of iron ore, as, for example, in the Narvik-Rotterdam trade, or in the proposed Chilian-United States trade, it may be possible to neglect requirements for other cargoes, and to seal off much larger hold spaces than would otherwise be possible. In other words, the ore carrier might be as specialized in its design as the oil tanker, which is generally quite unsuitable for any other cargo. There seems no reason why, in fact, a material such as iron ore should not be dealt with as efficiently and economically as to its transportation as oil and coal, which is certainly very far from being the case at present.

With this object in view, the author suggested some ten years ago that a great improvement in seaworthiness and important advantages in general efficiency would be obtained by increasing the depth of the double bottom to, say, 18 ft., or 20 ft., providing a raised platform for the ore, which, in conjunction with the wing bulkheads, would hold the cargo in a concentrated mass, as in a box or hopper, so that when the hatches were removed it might easily be tackled by large unloading grabs or buckets. This arrangement is shown diagrammatically in Figs. 4 and 5. This proposal (which by the way, was one of the first lake designs to have scantlings assigned for Lloyd's classification) was submitted to the shipowners of the Great Lakes, but while recognizing the advantages of the arrangement, the loss of hold capacity was so great as to prejudice its general usefulness.

Spheres of Usefulness.

It is curious to notice that this design, though discarded for the time being, seems likely nowadays to find a large scope in two very different lines of work—viz., in ore-carrying in the open sea, and in pulp-wood carrying in the Canadian lakes and rivers. In the first case, I propose the hopper-holds and deep-tank bottom for the concentration of the ore for easy discharge by grabs, and in the second case for the quick discharge

of the pulp-wood by flooding the holds. In both cases the absence of large areas of deck-plating between the hatch openings is imperative.

It is quite useless to concentrate the ore in a mass in a raised hopper hold if its loading and discharge have to be interfered with by large blind areas of deck material. In that case it would be better to retain the hopper longitudinal walls, but to reduce the double-bottom depth to normal, so that the unloading buckets or grabs might have ample space under the obstructing deck areas for the necessary swing to reach the concealed positions of the cargo. In Fig. 7 is illustrated a deep-sea ore-carrier with a raised double bottom and hopper-holds, and the largest possible areas of hatch openings. To close these openings between the coamings, it may be necessary to consider an entirely new type of hatch-cover.

Considerable success has already attended the use of hinged covers of steel plate, heavily reinforced with angle or channel stiffeners, but in the present case I should recommend a type of rolling-shutter hatch-cover travelling on the hatch-coamings, and easily controlled by some simple form of winding-engine, or even an ordinary ship's winch. The one object to attain, whichever form of cover is adopted, is that it shall not permit any of the cargo to be screened from the attack of the unloading appliances.

There are, of course, many ways of charging and discharging the holds of large bulk carriers. In some cases, hopper-holds with conveying systems underneath have enabled the vessel to dispense with shore unloading plant; in other cases systems of electric deck-cranes have attained very considerable success. As the size of the ore-carrier and the length of the average voyage increases, however, it becomes important to keep the ship and the unloading arrangements entirely separate. The time is not distant when we shall have large numbers of ocean-going ore steamers, exceeding in dimensions and dead-weight the largest ore-carriers of the Great Lakes, which will have to negotiate distances exceeding 15,000 miles each round trip. The cycle of operations involved in the economical handling of an ore cargo under these conditions necessitates the very latest and most up-to-date methods throughout. The hopper-hold ore-carrier and the automatic unloader are two of the features in this cycle which might well repay careful consideration by those interested in the ore trade in this country.

NEW VESSELS FOR C. P. R.

THE two new one-class cabin steamships which the C. P. R. Co. is building for its Transatlantic fleet, and which will be called the Melita and Minnedosa, are expected to be respectively in service by July and October next. They will have a length over all of 520 feet, with 67 feet beam, and the depth from bridge to keel will be 40 feet—therefore, while the same length as the Missanabie and Metagama, they will be wider and deeper. They will be fitted with a combination of turbine and reciprocating engines, driving three screws, and will have a sea speed of 15 knots per hour. They will accommodate over 500 cabin passengers and 1,506 third-class passengers.

A feature of the cabin accommodation will be the number of two-berth rooms, 50 on each ship. The public rooms for cabin passengers will be elaborately decorated, and will include a large lounge and smoking room on the promenade deck and a gymnasium; the main dining saloon will seat 300, and 550 can be accommodated at a sitting in the third-class dining room.

Like the Missanabie and Metagama, the Melita and Minnedosa will be equipped with Babcock & Wilcox patent davits, by means of which lifeboats can be launched from either side of the vessel, even if she had a considerable list. They will also have the "cruiser stern," which imparts greater stability and seaworthiness, while every known device for the safety of passengers will be provided, including double-bottom, wireless telegraphy, and submarine signalling apparatus.

The addition of these two new vessels will enable the C. P. R. to maintain a weekly Transatlantic service of the popular "one-class" (cabin) variety.

MASTERS' AND MATES' EXAMINATIONS.

THE regulations relating to the examinations of masters and mates of inland and coasting vessels have been amended by order-in-council. The following new definitions of masters' and mates' qualifications are given:—

Mate—A candidate must be not less than 19 years of age, and must have served two years at sea. He must have served one year as mate of a passenger or freight steamer on the Great Lakes, whilst holding a certificate of competency as mate of a passenger steamer on the inland waters.

Master—A candidate must be not less than 21 years of age and must have served three years at sea, one year of which he must have served as mate whilst holding a mate's certificate. He must have served one year as master of a passenger or freight steamer on the Great Lakes, whilst holding a certificate of competency as master of a passenger steamer on the inland waters.

Seamanship—In addition to the qualifications for a mate, he will be required to know how to act in a case of stranding; to answer any questions respecting currents and aids to navigation which the examiner may think proper to ask; to answer any other questions the examiner may think necessary to ask him concerning the duties of a master of the particular class of sailing vessel or steamer for which he desires a certificate.

NEW SUPER-DREADNOUGHT COMMISSIONED.

ACCORDING to a despatch received from Plymouth on April 23, the new Super-dreadnought Warspite has sailed from Devonport Dockyards for the Dardanelles and is now bombarding the Turkish forts in company with her sister ship, the Queen Elizabeth. The Warspite is even more heavily armed than the latter vessel.

Great secrecy was maintained at Plymouth and Devonport in naval circles regarding the departure of the new ship and her destination. On April 5 orders were received to get her ready for sea, and await further instructions from the admiral of the fleet. Torpedo-boat destroyers were sent out scouring the mouth of the channel on the lookout for submarines, as three had been reported cruising off Eddystone Lighthouse, which is only ten miles outside Plymouth Harbor.

At midnight on April 12 the searchlights on the big forts, the warships in the harbor and breakwater were all shut off. The only light left burning was the Eddystone, and then, with all lights doused, the Warspite steamed out in the darkness and started for sea with orders to report to the Admiral of the Mediterranean Squadron at Gibraltar. From there she was despatched to the Dardanelles.

The steamship Garth Castle, of the Union-Castle Line, which has been chartered by the Government, and converted into the hospital ship, is anchored off the Island of Tenedos at the entrance to the Dardanelles to receive the sick and wounded. The White Star Liner Celtic is also there as a hospital ship.

Receiver for Mercantile Marine.—After consultation with the attorneys, Judge Hough appointed Philip A. S. Franklin, on April 3, vice-president, to be receiver for the International Mercantile Marine Co. He was placed under a $50,000 bond and empowered to continue the company's business.

Lake Car Ferry Steamer, "Ontario No. 2," Launched at Toronto

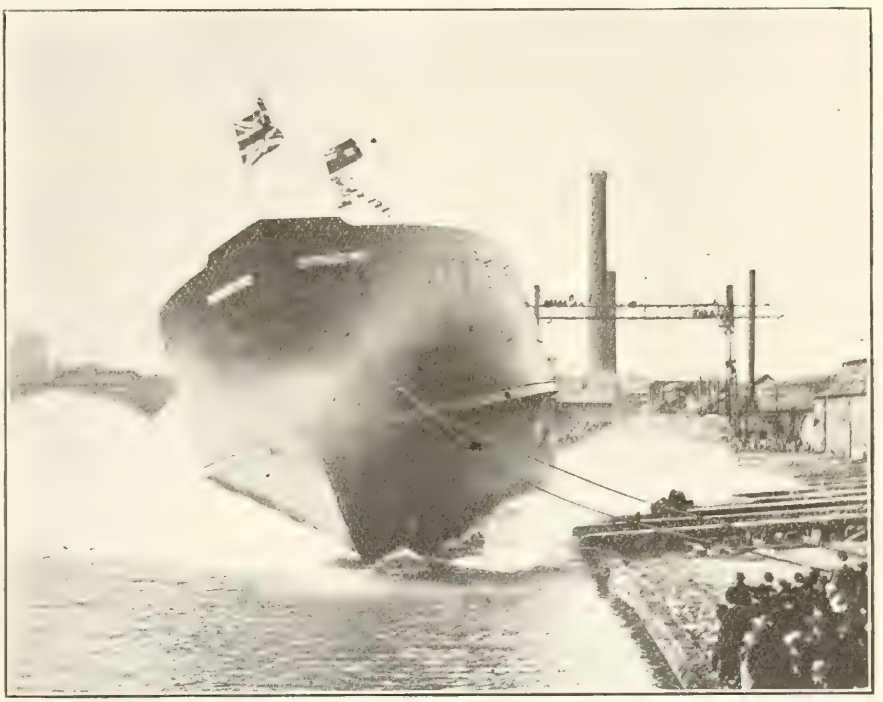
This latest product of the Polson Ironworks, Toronto, eclipses in its every feature the many otherwise fine vessels for a wide variety of service already built by that old-established firm, and continues to evidence the skill and capacity of our Canadian naval architects and shipbuilders are being in quality and quantity of no mean order, comparatively.

THE large car ferry "Ontario No. 2" was successfully launched on April 3 from the yards of the Polson Iron Works, Ltd., Toronto. The ferry was christened by Mrs. Hugh Calderwood, of Barrie, Ont., wife of the consulting naval architect for the Ontario Car Ferry Co., owners of the vessel. The launching operations were superintended by William Newman, naval architect for the builders, who also supervised the construction of the ferry.

The "Ontario No. 2," like her sister ferry, "Ontario No. 1," will run between Coburg, Ont., and Charlotte, N.Y. She is designed principally for carrying coal cars, but will have. in addition, accommodation for 1,000 passengers on the upper deck. On the lower deck are four tracks of rails capable of taking 30 cars. A service is maintained between the Grand Trunk Railway and the Buffalo, Rochester and Pittsburg Railway. The dimensions and general particulars of the vessel are as follows:

Length, 318 feet; beam, molded, 54 feet; depth to main deck, 20 feet 6 in.; draft loaded, 16 ft. 3 in.; tonnage, 5,400; horse-power, 4,500; capacity, 30 loaded cars; launching weight, 2,100 tons. She is about the same size as her sister ferry, but built more heavily and with capacity for more cars. Her bows are constructed for ice-breaking and the lifeboat and raft equipment are carried on the upper deck.

The Ontario No. 2 is a steel twin-screw car ferry of the shelter deck type, with four tracks for cars on the main deck, which is of steel throughout. A shelter deck of steel laid flush has a steel deck-house running throughout the greater part of the vessel's length, with accommodation therein for 1,000 passengers as well as officers and crew. There is a wooden pilot house and bridge on top of deck-house forward, and pilot-house at after end of same. Six transverse, watertight bulkheads extend from keel to main deck, and there is a longitudinal bulkhead on centre line. There are three water ballast tanks, two forward of boiler room and one aft of engine room. A steel lower deck is laid throughout the forward and after holds and both peaks, forming the tops of deep water ballast tanks. The designed capacity is 30 standard coal cars of 68 tons gross weight each, and 200



LAKE CAR FERRY "ONTARIO NO. 2" BEING LAUNCHED.

LAKE CAR FERRY "ONTARIO NO. 2," ON THE WAYS PREVIOUS TO LAUNCHING.

tons of fuel in bunkers. A working speed is guaranteed to be maintained of not less than 13 miles per hour in open water, with the ability to make 15 miles per hour when required.

The vessel is built on the transverse system with solid plate floors and bulb angle frames. The scantlings throughout are extra heavy for work in ice, as the ferry will run all the year round. Material and workmanship are in accordance with and to pass inspection of the Great Lakes Register, to their highest classification.

Machinery

Twin sets of jet condensing triple expansion engines are being installed, each having cylinders 20½ in.-33 in., and 54 in. diameter by 36 in. stroke, and making 110 r.p.m. The boilers, of Scotch type, are four in number, each being 14 ft. diameter by 12 ft. long. Howden's forced draft is a feature of the boiler equipment. Working steam pressure of 180 lb. per sq. inch will be employed. A full equipment of pumps for boiler feed, bilge, sanitary, fire and wash deck purposes has been installed.

The boiler feed will be taken care of by two 12×7×12 in. duplex, outside packed plunger, pot valve pumps, while a pump of the same type and size will be installed as a general service donkey pump. The bilge and sanitary pumps will be duplex type, 6×5×7 in., and the fresh water pump will be 4½×4×5 in., while a pump of the same size will be used for the main injection. There will be three ballast pumps installed, two duplex type, 12×16×18 in., and one 12 in. centrifugal pump. A multi-tubular feed water heater will be installed in the feed pump discharge line. The electric lighting plant consists of two direct-connected steam-driven generating sets of 15 k.w. and 20 k.w. respectively of Canadian General Electric Co. make. Two independent steam steering gears, windlasses, capstans, a powerful double drum moving winch, refrigeration plant, wireless outfit, heating system, also an equipment of lifeboats, life-belts, rafts and jackets contribute to the vessel navigation and passenger and crew comfort, and safeguarding in an emergency.

The work of construction was started on November 7, last, and delivery of the completed ferry is expected to be made about the middle of July this year. Captain Forrest of Cobourg will be in command of the Ontario No. 2, and Allan Nichol will be chief engineer.

At the conclusion of the launching ceremony, a buffet luncheon was served in the Polson Ironworks' offices, the guests being received by the president of the company, Col. J. B. and Mrs. Miller. Among those present were: Mr. and Mrs. Hugh Calderwood, Howard E. Kelly, vice-president G. T. R.; Col. and Mrs. J. B. Miller, A. H. Jeffrey, secretary of the company; Mayor Church, Toronto; Captain H. H. Miller, J. W. Greiner, chief engineer of the G. T. R. ferry system; J. F. McMillan, of the Kingston Shipbuilding Co.; W. Inglis, of John Inglis & Co., Toronto; Captain J. B. Foote, W. H. Smith, general manager of the Ontario Car Ferry Co.; G. A. Bowman, A.G.F.A. of the B. R. & P. Railway; Mr. and Mrs. William Newman, J. A. Sing; A. G. Webster, "Marine Engineering of Canada," etc.

Vigilance Appropriation.—It is reported that the directors of Furness, Withy & Co., have decided to set aside out of their profits the sum of $50,000 for division amongst the masters, officers and engineers of their own steamers and the steamers under their direct control and management, to be divided by the Board in their discretion at the end of the war, as a recognition, over and above the increase of wages granted, of the extra strain and vigilance necessary in consequence of the war. The allowance will only be made for continuous service, but will not be prejudiced by any illness or by any of the officers leaving to join his Majesty's forces.

Lakes to Ocean Navigation Opening.—Navigation in Canada connected itself with the port of Montreal on April 23, when the Canada Steamship Lines vessel W. H. Dwyer came through the Lachine Canal to deliver its 240,000 bushels of wheat at Elevator No. 1. The boat was delayed a day by the ice at the Soulanges Canal, having left Port Colborne on April 19. Although the W. H. Dwyer was the first of the down-stream of lake vessels to reach Montreal, and the City of Hamilton the second, six vessels which wintered in the port of Montreal passed up the canal on the previous day, April 22, on their way to the upper lakes. Among these were the Port Dalhousie, the Westerian and the Easton.

THE "ONTARIO NO. 2" AS SHE WILL APPEAR WHEN IN SERVICE.

THE ENGINE AND BOILER ROOM

A Department for the Exchange of Practical and Theoretical Data Relative to Design and Operation of Engines, Boilers and Their Auxiliaries.

THE INDICATOR DIAGRAM.

WHAT is known as the indicator diagram is constructed by the steam engine indicator. It has particular uses as follows:—

1—To determine mean effective pressure and indicated horsepower.

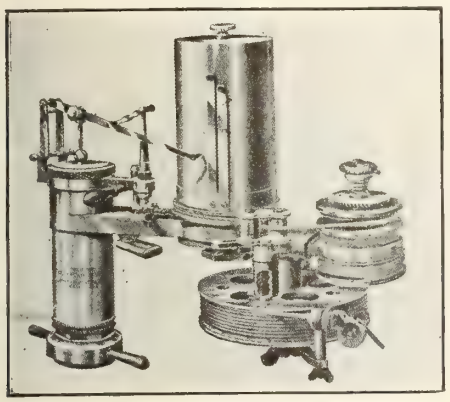


FIG. 1. INDICATOR WITH REDUCING MOTION ATTACHED.

2—To show when losses occur, such as back pressure, cylinder condensation, excess compression, etc.; also their amount.

3—To determine if steam pipes, ports and passages are large enough.

4—To show whether valve and governor settings and adjustments are correct. This includes steam distribution, wire drawing in steam and exhaust, the exact time at which the different stroke events occur, etc.

The indicator diagram of a good non-condensing engine would look very much like Fig. 3. The length over all is proportional to the length of the engine stroke and hence represents it to a certain scale. The furthest point to the left represents the beginning of the stroke, the distance to the middle, half stroke, and the extreme point to the right, the end of the stroke. Horizontal distances on the diagram represent two things, one of which is piston positions.

In very much the same way the height of any point on the diagram represents pressure to the scale of the spring. Thus, if the point (2) be 1⅝ inches above the atmospheric line M N, and the scale be 40, it means that, at a point about ¼ of the forward stroke, the pressure in the engine cylinder is $1\frac{5}{8} \times 40 = 65$ pounds. The points on the diagram where the cylinder events occur are denoted by the various points of contraflexure; that is, points where the curve changes direction. For instance, at (2), the point of cut off, the curve changes from a concave to a convex, and, at (6), the shape changes from a curve to a straight line. They can, therefore, be easily located by continuing one of the curves as at (2), and noting the point where it leaves the diagram.

Beginning with the point of admission (6), the piston, at the beginning of the stroke is almost stationary and, although the port opening is small, the pressure rises almost instantly to boiler pressure causing the pencil to rise vertically as shown by the line (6-1). At (1) the piston begins to move forward under full supply of steam until it reaches the point of cut-off (2). The pencil, therefore, draws a horizontal line at a height representing boiler pressure. The falling of the line before point (2) is reached is caused by the narrowing of the port opening or "wire drawing" just before it closes entirely.

At the point of cut-off, the supply of steam to the cylinder ceases, and, as the piston continues to move forward, the steam shut in the cylinder expands and its pressure falls as represented by the line (2-3). At (3), just before the end of the stroke, release occurs; the steam being allowed to escape. As a consequence its pressure falls rapidly to that of exhaust. The extreme point (4) represents the end of the stroke. The line (4-5) represents the return or exhaust stroke and its height above M N represents the exhaust pressure, usually from 3 to 6 pounds. At the point (5), just before the end of the return stroke, the exhaust port closes and entraps a portion of the steam in the cylinder. This is compressed by the piston as it completes the stroke and its pressure consequently rises to the point (6) when admission again occurs and another revolution is begun.

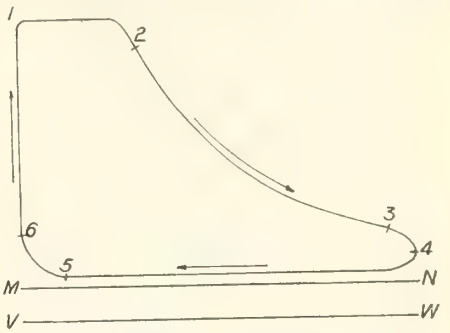


FIG. 3. INDICATOR DIAGRAM SHOWING THE CRITICAL POINTS IN THE ENGINE REVOLUTION.

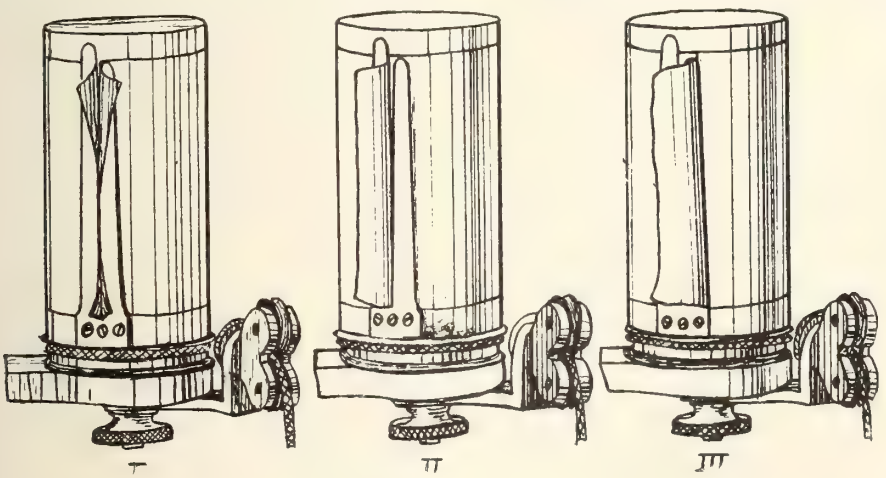


FIG. 2. METHOD OF PLACING THE INDICATOR CARD.

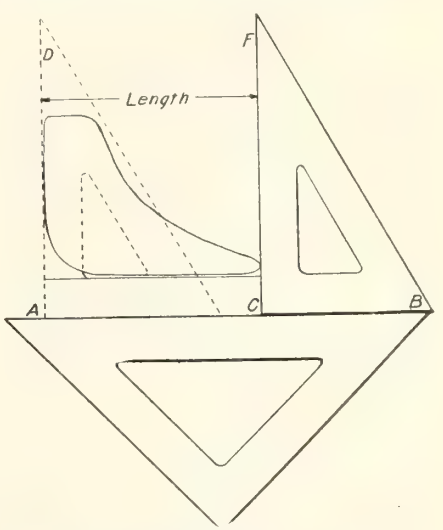


FIG. 4. DETERMINING THE LENGTH OF THE DIAGRAM BY MEANS OF SET SQUARES.

Critical Points in the Diagram.

For purposes of explanation, we draw the line of zero pressure, and this will be a horizontal straight line at a distance below the atmosphereic line representing the atmospheric pressure or 14.7 pounds.

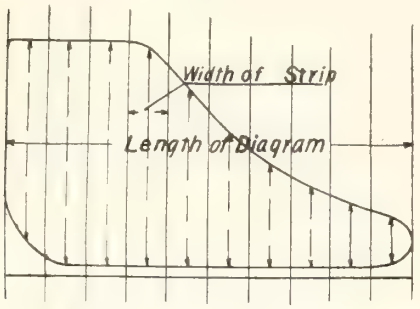


FIG. 5. DETERMINATION OF CARD AREA BY DIVIDING INTO STRIPS.

If the scale be 40, this distance would be 14.7 ÷ 40 = .3675 inch or very nearly 3/8 of an inch. The critical points of the diagram or the points at which the various valve events occur are located as follows:—

6—Represents the point of admission.
2— " the point of cut-off.
3— " the point of release.
5— " the point of compression.

The parts of the stroke throughout which the various actions are going on are represented by certain lines thus:—(6-2) is the period of admission; (2-3) the period of expansion; (3-5) the period of exhaust; (5-6) the period of compression.

The lines of which the diagram is made up are named as follows:—(6-1) is the admission line; (1-2) the steam line; (2-3) the expansion line; (3-4) the release line; (4-5) the exhaust line; (5-6) the compression line; M-N the atmospheric line, and V-W the vacuum line.

Indicated Horsepower.

In order to determine the horse-power of an engine, the mean effective or average pressure acting on the piston throughout the stroke must be known. This is found from the indicator diagram by determining its average height.

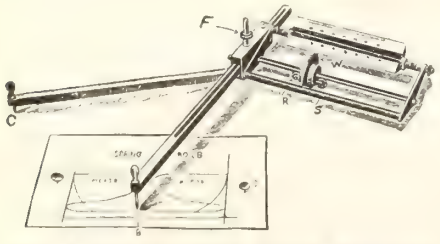


FIG. 6. PLANIMETER WITH SLIDING WHEEL AND STATIONARY SCALE.

The average height of the diagram would be the same as the height of a rectangle having the same area and the same length. To find the average height of the diagram and hence the mean effective pressure, it is necessary to determine its length and its area.

The exact length can be easily measured by means of a pair of triangles or set squares as shown by Fig. 4. The lower triangle must be carefully set parallel to the atmospheric line and, with the other, fine lines are drawn through the extreme points of the diagram. The distance between these vertical lines is the length of the diagram and is best measured by means of a decimal scale.

The exact area is somewhat more difficult to determine. A very close approximation can be obtained, however, by dividing the diagram up into a number of vertical strips of equal width, as in Fig. 5; the greater the number of strips the greater the accuracy obtained. The total length of all the strips multiplied by their width will be the area. This total length can be quickly found by means of a long strip of paper. Placing the paper along the middle of the first strip, mark its length, then place the mark at the beginning of the second strip, and mark its length and so on until the lengths of all the strips measured along their centre lines have been marked end on end along the edge of the paper. This total length can now be easily measured with a rule. Multiplying this length by the width of the strips will give the area. Thus, if the length be 13½ inches and the divisions be 1-10 inch in width, the area of the diagram will be 13.5 × .1 = 1.35 square inches.

FIG. 7. PLANIMETER WITH REVOLVING SCALE.

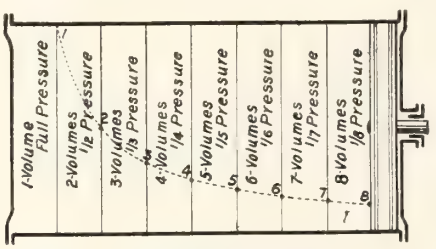


FIG. 8. CURVE SHOWING THE RELATION OF VOLUME TO STEAM OR GAS PRESSURE.

Dividing the area by the length will give the average height thus, if the area be 1.35 square inches and the length 3 inches, the average height will be 1.35 ÷ 3 = 0.45 inch. This multiplied by the scale of the diagram will give the average or mean effective pressure. Let the scale be 40. Then the mean effective pressure is 40 × .45 = 18 pounds.

Areas by Planimeter.

The area of the diagram or any flat irregular surface is most conveniently found by means of a planimeter two types of which are illustrated. The general principle is the same in both, but the method of registering the area is somewhat different. With the instrument shown in Fig. 6, the procedure is as follows: The card is pinned down to a board or sheet of paper having a hard, smooth, flat surface. Holding the point B in the centre of the diagram, the point C is pressed into the board so that its arm is approximately at right angles to the main bar. The wheel W is slid along its axis until its edge is opposite the zero mark on the scale and the outline of the diagram is carefully followed by the point B in a clockwise direction, care being observed to end exactly at the starting point. For greater accuracy the diagram can be gone around twice and the result divided by 2. The area is measured on the scale by the sideways motion of the wheel. The working of the instrument shown in Fig. 6 is very much the same except that the area is measured not by the axial motion but around the graduated circumference of the wheel D. The stationary point P is held down by means of a weight and the outline is traced by means of the point F.

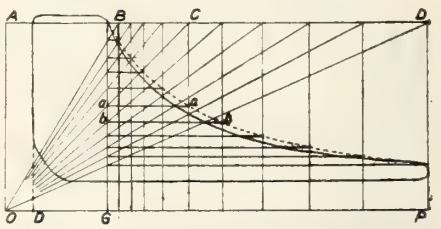


FIG. 9. CONSTRUCTION OF THE THEORETICAL CURVE.

Both of these instruments can be used for determining the M. E. P. directly by making certain adjustments of the long arm. Thus, in the instrument shown in Fig. 6, the points F and B are set to the length of the card and the scale is placed next the wheel corresponding to the scale of the spring. Upon tracing the diagram as before, the M.E.P. may be read directly on the scale.

It will be observed that the area of the card is, in reality its length multiplied by its average height. Also, the height represents pressure or force and the length represents stroke or distance. Now, work may be described as force

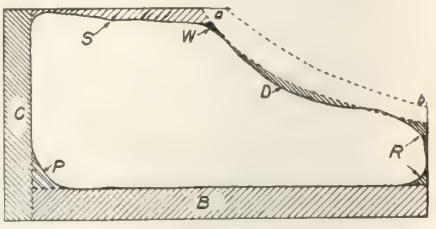


FIG. 10. DIAGRAMATIC REPRESENTATION OF COMMON LOSSES.

multiplied by the distance through which it acts. Hence the area of the card represents amount of work and any gain in area of the card represents increased work done by the engine. Likewise, any adjustments of the engine that tend to produce a card with a smaller area, lessen the power delivered by a corresponding amount.

Dry steam, like a perfect gas, occupies a space inversely proportional to its pressure. Thus, if the pressure be doubled, the volume is one-half and as the steam in a cylinder expands, its pressure drops in a direct proportion. According to this principle, we can draw an approximately correct expansion line as shown in Fig. 8. This, however, is not exact on account of the fact that the temperature of the steam in the cylinder varies more or less.

The Theoretical Expansion Curve.

A method of constructing this curve is shown in Fig. 9, and the proceude is as follows: As the steam in the clearance space expands along with the steam in the stroke volume, the amount of expanding steam must include both. The length DP, say 2 inches, of the diagram represents the stroke volume of the cylinder, and let this be 2,000 cubic inches. Now, if the clearance volume be 200 cubic inches, the total volume of steam in the cylinder at the point of cut-off B, is represented by the distance DG plus OD, the latter representing 200 cubic inches. As 2 inches represents 2,000 cubic inches, OD, which represents 200 cubic inches, must be 0.2 inch.

Draw the line OA at right angles to the atmospheric line and 0.2 inch to the left of the diagram. Draw also the vacuum line OP and also AD parallel to this through the point of cut-off. The rectangle may now be completed by drawing in DP representing the end of the diagram. Draw any number of vertical lines, including one through the point of cut-off. Through the point O draw lines OB, OC, etc., to the intersection of AD, with the vertical lines. From the points such as (a) and (b) where these lines intersect BG, draw the horizontal lines (aa), (bb), etc. The points in which these lines intersect the corresponding vertical lines are points on the theoretical expansion curve shown complete by the dotted line.

Losses Shown by Diagram.

It has been stated that losses of work in the engine are indicated by losses of area in the diagram, and the location of these areas can be seen in Fig. 10, which has been drawn in the same way as Fig. 9, except that the upper horizontal line represents the boiler pressure. The area C represents the loss due to clearance, that marked S is due to steam pipes, and the falling of the steam line to narrowness of ports, obstructed steam pipe, etc. The area W is due to the wire drawing by the slide valve. Corliss and other releasing gears reduce this very much. The loss D is caused by cylinder condensation; note, however, that it disappears towards the end of the stroke. The opening of the exhaust valve, and B is due to back pressure which may be reduced by using a condenser. The small area R is caused by the necessary early area P represents loss due to compression.

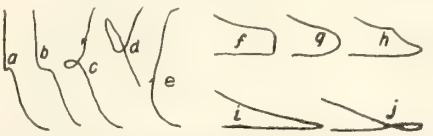


FIG. 11. DEFECTIVE DIAGRAM DETAILS.

By Decreasing The	ADMISSION	EXPANSION	EXHAUST	COMPRESSION
Outside Lap	Begins Later Ends Earlier Period Reduced	Begins Earlier Ends as Before Period Increased	Unchanged	Begins as Before Period Depends On Admission Point
Inside Lap	Unchanged	Begins as Before Ends Later Period Increased	Begins Later Ends Earlier Period Reduced	Begins Earlier Ends as Before Period Increased
Angular Advance	Begins Earlier Ends Earlier Period Unchange	Begins Earlier Ends Earlier Period Unchanged	Begins Earlier Ends Earlier Period Unchanged	Begins Earlier Ends Earlier Period Unchanged
Valve Travel	Begins Earlier Ends Later Period Increased	Begins Later Ends Earlier Period Reduced	Begins Earlier Ends Later Period Increased	Begins Later Ends Earlier Period Reduced

FIG. 12. EFFECT OF ALTERATIONS TO VALVE AND CONNECTIONS ON CYLINDER EVE NTS.

Correction of Engine Faults.

The indicator diagram simply registers the time at which cylinder events occur and their effect upon the steam pressure. In correcting faults, the type of engine, the speed at which it runs and many other considerations must be taken into account. For instance, there must be considerable loss of area at release and compression in high-speed engines, also, the condensation loss must necessarily be greater in slow-speed engines with a high ratio of expansion.

Single-valve engines necessarily have all events tied together so that, if one event, say that of cut-off, occur late, all will be correspondingly late. In four-valve engines, however, admission and cut-off are separated from release and compression and their diagrams must be studied in detail. Some of these are shown in Fig. 11, which refer to compression and release. The lines (a), (b) (c) and (d) show excess compression and admission. The loops on (c) and (d) are known as compression loops and the areas they contain must be subtracted from the main area when determining mean effective pressure. The sloping line (e) shows good compression and late admission. The outline (f) is that of a release which could only be obtained in a very slow speed engine with ample and quick exhaust opening, while (g) is normal for moderate-speed engines and (h) shows release too early. The lines (i) (j) denote excess expansion, which, in the latter, goes below the back pressure line, and, as soon as the exhaust opens the pressure rises, forming an expansion loop.

The effect of altering the time at which the various events occur by manipulating the valve gearing is stated in concise form in the table, Fig. 12. In alteeing valve connections to improve one condi-

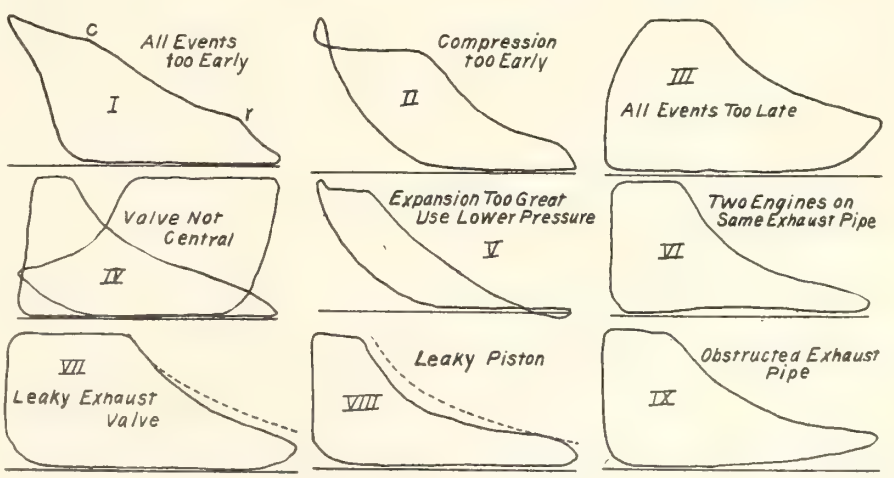


FIG. 13. TYPICAL DIAGRAMS RESULTING FROM DERANGED VALVE GEAR.

tion, however, care should be taken to foresee its effect, if any, upon others.

Some typical faulty cards are shown in Fig. 13. In (1) all events are seen to be developing too early, while (3) shows the opposite extreme, all happening too late. Both of these cards naturally suggest a wrongly placed eccentric and consequently an incorrect angular advance. When the valve motion is not central with the ports, a combination of these troubles as shown in (4) occurs, one end of the cylinder being early and the other late. Diagram (2) indicates an

FIG. 14. SERIES ILLUSTRATING EFFECT OF "LINKING UP" OF LINK MOTIONS.

excess of compression resulting in the loop as shown. The area of all loops, of course, must be subtracted from the main diagram as before stated. Diagram (5) shows too great expansion. This would be improved by lowering the steam pressure and using a later cut-off.

When two engines connected on the quarter to a single crank-shaft exhaust into the same pipe, the result is sometimes like diagram (6). Near the middle of the return stroke of one engine both are exhausting at the same time, which raise the pressure in the exhaust pipe with a corresponding effect on the exhaust line of the diagram.

A leaky exhaust valve would cause the pressure to fall below the theoretical line something like diagram (7). As, up to the time of cut-off, the cylinder is in direct connection with the boiler, this trouble is not shown by the steam line. A leaky piston is denoted by the expansion line in number (8). It is to be observed that excessive cylinder condensation has very much the same effect except that in the latter case the subsequent re-evaporation causes the lines to come together near the end of the stroke. Leaky valves and pistons can be tested for mechanically with very little trouble. The effect on the exhaust line of a small or obstructed exhaust port or passage is seen in diagram (9), which suggests the cure in itself.

The cards taken from different types of engines are necessarily different in shape and hence, to properly diagnose a card from any particular engine, the type of card to expect should be reasoned out and understood. The high-speed engine will show a high compression and late release. Slide-valve engines will, in most cases, show considerable wire-drawing which is absent in the Corliss or Wheelock. Fig. 14 shows the effect of the reduction of travel as experienced in linking-up. The air compressor will often show the effect of opening valves and the ammonia compressor shows this to a marked extent.

Loss in Steam Chest.

The falling of the steam line as shown in Fig. 15 may be caused by narrow ports, obstructed passages or defective throttle-valve. If any doubt exists it is well to transfer the indicator to the steam-chest and take a steam-chest diagram, it being shown somewhat exaggerated in the same figure. This may be done with the same setting of reducing motion and on the same or a different card. The boiler pressure line B P is first drawn and subsequently the steam-chest diagram (af).

The forward stroke begins at (a) and, as the steam flows into the cylinder, the steam-chest pressure falls, as shown by (a b). At cut-off, the pressure again rises momentarily above and then back to normal. It remains normal until the end of the stroke and again falls accordingly to (f e) during admission for the return stroke. The areas (a b) and (e f) should, of course, be as small as possible and the whole diagram is often little more than a straight line. If the areas are very noticeable, however, the

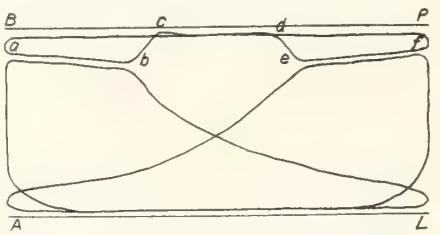


FIG. 15. DOUBLE END DIAGRAM SHOWING POSITION OF STEAM CHEST DIAGRAM AND BOILER PRESSURE LINE.

natural cure is a larger steam pipe or a wider opening throttle valve.

THE ARMORED CRUISER.

THE progress of the armored cruiser, so far as the British Navy is concerned, says the Liverpool Journal of Commerce, has been one of continuous increase in dimensions, speed, offensive and defensive powers; in fact, this class of vessel has grown exceedingly rapidly even for a warship.

First Armored Cruiser.

The first armored cruiser for our navy was the Shannon, built in 1875. This vessel was 260 feet long, and had a displacement of 5,400 tons. She carried two 18-ton and seven 12-ton muzzle loading guns, and a number of smaller weapons. Her armor belt was 8¾ in. thick, and she was capable of just over 12 knots. A most interesting point in connection with the Shannon is that the vessel was provided with a ram which was detachable. In peace time the ship left her ram in store, and when war was declared she was supposed to run to port to fetch this appendage.

"Imperieuse" and "Drake."

In 1883 the Imperieuse was built, and she represented a big advance. Her displacement was 8,400 tons and speed practically 17 knots. In 1899 the Cressy, the pioneer of the large fast armored cruiser was constructed. She was of 12,000 tons displacement, and carried two 9.2-in. and twelve 6-in. guns. Her speed was 22½ knots. Another big advance in speed was made in the Drake class of 14,000 tons built in 1901, some of these vessels attaining a speed of 25 knots on trial.

The "Kent" Class.

The next class, to which belongs the cruiser Kent, now famous for her magnificent burst of speed during the Falkland Island affair, was of only 9,800 tons displacement, and the main armament consisted of 6-in. guns only. In 1904 the displacement of this class of vessel again rose to 13,550 tons, the extra weight being chiefly employed to increase the armament. The last of the armored cruisers proper was the Minotaur class, having a displacement of 14,600 tons. These were 23-knot boats, and they carried a very mixed armament, comprising four 9.2-in., ten 7.5-in. and sixteen 12-pounder weapons.

Curiously enough one of this class was named the Shannon. Comparing the two namesakes, the first of the line built in 1875, and the last, completed in 1908, we see that the displacement jumped from 5,400 tons to 14,600 tons, and the speed rose from 12 to 23 knots, practically doubled. It is interesting to note that the armor of the first Shannon was 8¾ in. thick, while the maximum thickness of belt in the namesake was only 6 in. Of course, there can be absolutely no comparison between the value of the two types of armor.

High-Speed Armored Type Vessels.

After the Minotaur class, Britain suddenly increased the displacement and power of her high-speed armored vessels to such an extent that they cannot be properly called armored cruisers, because they are really representatives of a quite distinctive type. The first of the new type, the Invincible, was of 17,250 tons displacement, a notable advance of 2,650 tons. Her speed was 26 knots, and her main armament consisted of eight 12-in. guns.

As a matter of some interest we quote here the known particulars of the latest representative of the new type, the battle cruiser Tiger. She is the heaviest ship in the British Navy, being of 28,000 tons displacement. Her length is 660 feet, and her speed 28 knots on a reported horse-power of 100,000 from her Curtis turbines. Her armament consists of eight 13.5-in., together with twelve 6-in. guns.

Diesel Engines--Lloyd's Construction and Survey Rules

The gradual development of the Diesel engine and the widening scope of its application to marine propulsion has led to the necessity of a set of rules being formulated by Lloyd's Registry, equivalent in their make-up and requirement to those in force for steam-engine-propelled vessels. The various features are here set forth in detail.

THE following instructions have been issued by Lloyd's Registry of Shipping relative to the construction and survey of Diesel engines and their auxiliaries on board ship.

In vessels propelled by Diesel oil engines, the rules as regards machinery will be the same as those relating to steam engines, so far as regards the testing of material used in their construction and the fitting of sea connections, discharge pipes, shafting, stern tubes and propellers. In cases where the designed maximum pressure in the cylinders does not exceed 500 lb. per square inch, the diameters of the crank shaft of the main engines are not to be less than those given by the following formula:

Diameter of crank shaft =

$$\sqrt[3]{[D^2 \times (AS + BL)]}$$

where D = diameter of cylinder, S = length of stroke, L = span of bearings adjacent to a crank, measured from inner edge to inner edge. The values of (AS + BL) are given in the following table:

Table I.

4-Cycle Single-Acting Engine.	2-Cycle Single-Acting Engine.	Values of the Co-efficients.
4 or 6 cyls.	2 or 3 cyls.	.089S + .056L
8 cyls.	4 cyls.	.099S + .054L
10 or 12 cyls.	5 or 6 cyls.	.111S + .052L
16 cyls.	8 cyls.	.131S + .050L

For auxiliary engines of the Diesel type, the diameters may be five per cent. less than given by the foregoing formula.

In solid forged shafts, the breadths of the webs should be not less than 1.33 times and the thickness not less than 0.56 times the diameter of the shaft as found above, or, if these proportions are departed from, the webs must be of equivalent strength. Where no flywheel is fitted, the diameter of the intermediate shaft must not be less than given by the formula:

Diameter of intermediate shaft = co-efficient $\sqrt[3]{(D^2 \times S)}$ where D = diameter of cylinder, S = stroke of piston, and the value of the co-efficient is given by the following table:

Table II.

4-Cycle Single-Acting Engine.	2-Cycle Single-Acting Engine.	Values of the Co-efficients.
4 cyls.	2 cyls.	.456
6, 8, 10 or 12 cyls.	3, 4, 5, or 6 cyls.	.436
16 cyls.	8 cyls.	.466

Where the stroke is not less than 1.2 times nor more than 1.6 times the diameter of the cylinder, (.735 D + .273 S) may be taken instead of $\sqrt[3]{(D^2 \times S)}$.

In cases where flywheels are fitted, the following value of the co-efficient may be taken for determining the size of the intermediate shaft abaft the flywheel shaft.

Table III.

4-Cycle Single-Acting Engine.	2-Cycle Single-Acting Engine.	Values of the Co-efficients.
4 cyls.	2 cyls.	.405
6 cyls.	3 cyls.	.400
8 cyls.	4 cyls.	.409
10 cyls.	5 cyls.	.420
12 cyls.	6 cyls.	.427
16 cyls.	8 cyls.	.461

The diameter of the flywheel shaft must be at least equal to that of the crank shaft.

The diameter of the thrust shaft measured under the collars must be at least 21-20ths that of the intermediate shaft. The diameter may be tapered off at each end to the same size as that of the intermediate shaft.

The diameter of the screw shaft must not be less than the diameter of the intermediate shaft (found as above) multiplied by $(.63 + \frac{.03P}{T})$, but in no case must it be less than 1.07T, where P = the diameter of the propeller in inches, T = the diameter of intermediate shaft in inches.

The size of the screw shaft is intended to apply to shafts fitted with continuous liners the whole length of the stern tube, as provided for in Section 18, paragraph 3, of the Rules for Engines and Boilers. If no liners are used, or if two separate liners are used, the diameter of the screw shaft should be 21-20ths that given above.

The diameter of the screw shaft is to be tapered off at the forward end to the size of the thrust shaft.

If the designed maximum pressure in the cylinders exceeds 500 lb. per square inch, the diameters of the shafting throughout must be increased in the proportion of

$$\sqrt[3]{\frac{\text{maximum pres. in lb. per sq. inch,}}{500}}$$

Where the cylinder liners are made of hard close-grained cast iron of plain cylindrical form, accurately turned on the outside as well as bored on the inside, so that their soundness can be ascertained by inspection, and their thickness at the upper part is not less than 1-15th of the diameter of the cylinder, they need not be hydraulically tested by internal pressure. If, however, they are made of complicated form, the question of testing must be submitted.

The water jackets of the cylinders and the water passages of the cylinder covers and pistons must be tested by hydraulic pressure at 20 lb. per square inch, and must be perfectly tight at that pressure.

The exhaust pipes and silencers must be water cooled or lagged by non-conducting material, where risk of damage by heat is likely to occur. The cylinders are to be fitted with safety valves loaded to not more than 40 per cent. above the designed maximum pressure in the cylinders and discharging where no damage can occur. The air compressors and their coolers are to be made so as to be easy of access for overhaul and adjustment.

In single screw vessels, an auxiliary air compressor is to be provided of sufficient power to enable the main engines to be kept continuously at work when the main compressor is out of action. If the manoeuvring gear is arranged so that the engines can be kept continuously at work with some of the cylinders out of action, the auxiliary

compressor need only be of sufficient power to enable the engines to be kept at work under these conditions.

In twin-screw engines, in which two sets of compressors are fitted, the auxiliary compressor must be of such size as to enable it to take the place of either of the main compressors. If in such engines each main compressor is sufficiently large to supply both engines, a smaller auxiliary compressor will be sufficient. A small auxiliary compressor, worked by a steam engine, or by an oil engine not requiring compressed air, is to be fitted for first charging the air receivers.

At least one high-pressure air receiver is to be arranged with connections to enable it to be used for fuel injection, in case the working receiver of either main engine is out of use from any cause.

The circulating pump sea suction is to be provided with an efficient strainer which can be cleared inside the vessel.

Air Receivers.

Compressed air receivers for starting air are to be supplied of sufficient capacity to permit of twelve consecutive startings of the engines without replenishment. Cylindrical receivers for containing air under high pressure, used either for starting or for the injection of fuel in oil engines, may be made either of seamless steel or of welded, or riveted, steel plates.

Quality of Material.

If made of welded or riveted steel plates, the ordinary rules regarding steel material for boilers apply, which provide that where welding is employed, either in the longitudinal seams or at the ends, the material must have a tensile strength not exceeding 30 tons per square inch (Section 4, par. 7, Rules for Engines and Boilers). In these cases, the welding must be lap welding; neither oxy-acetylene nor electric welding will be permitted.

In the case of seamless receivers, the rules for material will be the same as for boiler shells, but the permissible extension may be 2 per cent. less than that required with boiler plates.

Tensile and bend tests are to be made from the material of **each** receiver. When they are welded or riveted, the tests may be made and the thicknesses verified before the plates are bent into cylindrical form. In the cases of seamless receivers, the thicknesses must be verified by the surveyor before the ends are closed in, and at this time the surveyor shall select and mark the test pieces required from either of the open ends of the tube. The test pieces are to be annealed before test, so as to properly represent the finished material. The permissible working pressure for welded or seamless receivers is to be determined by the following formulae:

Maximum working pressure in lb. per sq. inch $= \frac{C \times S \times (T-2)}{D}$ for thicknesses of $\frac{5}{8}$ in. and above.

$= \frac{C \times S \times (T-1)}{D}$ for thicknesses below $\frac{5}{8}$ inch.

where S = minimum tensile strength of the steel material used, in tons per sq. inch; T = thickness of the material, in sixteenths of an inch; D = internal diameter of cylinder, in inches; C = co-efficient as per following table: Co-efficient 77 for seamless receivers of thickness of $\frac{5}{8}$ in. and above; 69 for seamless receivers of thickness below $\frac{5}{8}$ in.; 54 for welded receivers of thickness of $\frac{5}{8}$ in. and above; 48 for welded receivers of thickness below $\frac{5}{8}$ inch:

For flat ends welded into the cylindrical shells, the thickness must not be less than

$$T = \frac{D}{17} \times \sqrt{P}$$

where T = thickness, in sixteenths of an inch; D = internal diameter, in inches; P = working pressure, in lb. per sq. in.

Working Pressure for Receivers.

The permissible working pressure for receivers made of riveted steel plates is to be determined by the rules regulating the working pressure of boilers. Each welded or seamless receiver shall be carefully annealed after manufacture, and before the hydraulic test. Each welded or seamless receiver shall be subjected to a hydraulic test of twice the working pressure, which it shall withstand without permanent set. Each receiver made of riveted steel plates is to be tested by hydraulic pressure to twice the working pressure for pressures up to 200 lb. per square inch. Where higher working pressures are used, the test pressure need not be more than 200 lb. per sq. inch above the working pressure.

All receivers above six inches internal diameter must be so made that the internal surfaces may be examined, and, wherever practicable, the openings for this purpose should be sufficiently large for access. Means must be provided for cleaning the inner surfaces by steam, or otherwise. Each receiver which can be isolated must have a safety valve fitted, and adjusted to the maximum working pressure. If, however, the air compressor is fitted with a safety valve so arranged and adjusted that no greater pressure than that permitted can be admitted to the receivers, they need not be fitted with safety valves. Each receiver must be fitted with a drain arrangement at its lowest part, permitting oil and condensed water to be blown out.

Pumping Arrangements.

The requirements of the pumping arrangements for the various holds, double bottoms or other ballast tanks, etc., are to be the same as required in steam vessels of the same size.

The engines are to be fitted with two bilge pumps, which are to be so arranged that either can be overhauled while the other is at work. In twin-screw vessels, one bilge pump upon each engine will be approved. These pumps are to be arranged to draw from all compartments. Independent power-driven pumps may be fitted in lieu of these, if desired.

A steam pump, or equivalent power-driven pump, is also to be provided with connections to enable it to draw from all compartments and from the sea. It must be arranged to discharge overboard and also on deck to the fire service pipes. It must have at least one suction to the engine-room bilge distinct from those connected with the bilge pumps, so that it may be used for pumping from the engine-room when the bilge pumps are being used upon other parts of the vessel.

In addition to the above, where water ballast is used, the water ballast pump must have one direct suction from the engine-room bilges. (This is in lieu of the bilge injection required with steam engines.)

General.

For the ordinary fuel tanks the requirements of Section 49 will apply. The daily service and other separate tanks must be tested, with all their fittings, with a head of water of 12 ft. above their highest points. They must be fitted with air pipes discharging above the upper deck. If they are fitted with glass gauges for indicating the quantity of oil contained in them, arrangements must be made for readily shutting off the gauges in the event of the breakage of the glass, and for preventing any damage from leakage of oil.

Special attention must be given to the ventilation of the engine-room.

If the auxiliaries are worked by electricity, the cables in connection with them must be in accordance with the rules for cables for electric light.

It is recommended that all pipes conveying fuel oil should, as far as possible, be made of steel or iron, rather than copper, owing to the rapid corrosion of copper pipes when using oil containing sulphur.

Spare Gear.

The articles mentioned in the following list will be required to be carried, viz.: One cylinder cover complete for

the main engines, with all valves, valve seats, springs, etc., fitted to it. In addition one complete set of valves, valve seats, springs, etc., for one cylinder of the main and of the auxiliary Diesel engines, and fuel needle valves for half the number of cylinders of each machine. One piston complete, with all piston rings, studs, and nuts for the main engines; in addition, one set of piston rings for one piston of the main and of the auxiliary Diesel engine; one complete set of main skew wheels for one main engine; two connecting rods, or piston rod, top-end bolts and nuts, both for main and for auxiliary Diesel engines; two connecting rod bottom end bolts and nuts, both for the main and for the auxiliary Diesel engines; two main bearing bolts and nuts, both for the main and for the auxiliary Diesel engines; one set of coupling bolts for the crank shaft; one set of coupling bolts for the intermediate shaft; one complete set of piston rings for each piston of the main and of the auxiliary compressors; one-half set of valves for the main and for the auxiliary compressors; one fuel pump complete for the main engine, or a complete set of all the working parts; one fuel pump for the auxiliary Diesel engine, or a complete set of all working parts; one set of valves for the daily fuel supply pump; one set of valves for the water circulating pumps; one set of valves for one bilge pump; one set of valves for the scavenge pump, where lift valves are used; a quantity of assorted bolts and nuts, including one set of cylinder cover studs and nuts; lengths of pipes suitable for the fuel delivery and the blast pipes to the cylinders, and the air delivery from the compressors to the receivers, with unions and flanges suitable for each.

Periodical Surveys.

The engines are to be submitted to survey annually, and in addition are to be submitted to a special survey upon the occasion of the vessels undergoing the special periodical surveys Nos. 1, 2 and 3 prescribed in the Rules, unless the machinery has been specially surveyed within a period of twelve months, in which case the annual survey will be sufficient. The boilers, if fitted are to be subjected to the same surveys as required by Section 19 of the Rules for Engines and Boilers.

Special Surveys.

At these special surveys, the main engines and the auxiliary engines are to be examined throughout, viz.: All the cylinders, pistons, valves and valve gears, connecting rods and guides, pumps, crank, intermediate and thrust shafts, propellers, stern bushes, sea connections and their fastenings, are to be examined. The air compressors are also to be examined. The air receivers are to be cleaned and examined and, if necessary, tested, as provided for in the following paragraph.

Annual Surveys.

The whole of the parts of the engines which the engineers of the vessel open up for adjustment and overhaul should be examined and reported upon. The survey must include, for each main engine, the examination of at least two pistons, two cylinder covers and their valves, two connecting rods and their brasses, both top and bottom ends, two of the main bearings and crank shaft journals, and one of the tunnel bearings. If these are all satisfactory, their condition may be taken as representing that of the other similar parts.

In the auxiliary Diesel engines, a similar course must be adopted, but in this case one of each of the parts mentioned of each engine will be sufficient, if found to be satisfactory. The valve gear of all the Diesel engines should be examined, as far as practicable, without complete dismantling.

The air receivers must be examined internally if possible, and, together with the air pipes from the compressors, must be cleaned internally by means of steam, or otherwise. If the air receivers cannot be examined internally, they must be tested by hydraulic pressure to twice the working pressure at each alternate annual survey, attention being specially given to the welding of the ends and of the longitudinal joints. The pumps and air compressors must be examined and tried under working conditions. If found to be satisfactory, they need not be dismantled.

The manoeuvring of the engines must be tested under working conditions.

If the examination reveals any defects the surveyor should recommend such further opening up as he may consider to be necessary.

Survey of Screw Shafts. — Screw shafts are to be drawn and examined at intervals of not more than two years.

Nominal Horse Power.

The following rule is to be used for determining the nominal horse power of Diesel engines in regulating the fees for their survey—namely:

$$NHP = \frac{N \times D^2 \sqrt{S}}{80}$$ in the case of single-acting engines of the 4-cycle type.

$$= \frac{N \times D^2 \sqrt{S}}{40}$$ in the case of single-acting engines of the 2-cycle type, and

$$= \frac{N \times D^2 \sqrt{S}}{20}$$ in the case of double-acting engines of the 2-cycle type.

where D = diameter of cylinder in inches, S = stroke of piston in inches in ordinary reciprocating engines, = twice the stroke of piston in the case of engines of the "Junker" type, N = number of cylinders.

SHIPBUILDING IN GREAT BRITAIN.

IT would not be far from the mark to say that mercantile shipbuilding is rapidly ceasing to exist so far as many yards on the Clyde and North-East Coast are concerned. Large and small establishments alike are concentrating every energy on the construction and completion of vessels of all descriptions required for warlike purposes to the exclusion of merchant ships, and even bridge building firms have been pressed into service for the building of certain types of vessels required by H.M. Government. The demand there for labor is exemplified in the widely-circulated advertisement of William Doxford & Sons, shipbuilders and engineers, of Sunderland, who are offering to colliers and others out of employment good, steady, laboring work at wages from 36s. to 39s. per week, with overtime, in addition, up to 33 per cent., and with the further attraction that they will be supplied by the firm with certificates and badges showing that they are employed on war service.

According to well-founded reports, certain works on the North-East Coast and elsewhere, usually occupied in marine and general engineering, have been taken over by the Government—presumably for the manufacture of shells.

With such an extraordinary combination of circumstances, and with the excessively high prices at present being quoted for steel and other materials, it is not surprising that some shipbuilding firms are declining to quote at all for new tonnage, while those who are still willing to do so are only able to discuss the question of completion and delivery in the most vague manner. The number of inquiries circulating for the construction of mercantile vessels is, of course, insignificant.

Navigation on the Yukon.—Despite indications of an early breaking up of the ice in the Yukon River, in Alaska, navigation on that stream will not open up until about June 1. Officers of the White Pass and Yukon route, operating steamboats from the head waters at White Horse, Y.T., to the mouth of the river at St. Michael, Alaska, say the low stage of the water along the fifty-mile stretch between White Horse and Lake Lebarge makes it inadvisable to start the river boats ahead of the usual time.

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NAVAL AND MILITARY PHASES OF THE WAR.

OWING to the fact that considerable interest has been aroused in circles outside of those directly concerned with the manufacture of munitions of war in Canada, we will include in succeeding issues a series of several articles bearing thereon and dealing with topics that the War in its various phases, naval and military, bids all of us seek to be more familiar with. As our navy has played, and will continue to do so right up to the end of the conflict what has been the most impressive although least spectacular role, and has thereby exerted an immeasurably favorable effect on our merchant marine in its every sphere, particular prominence will of course be given to that feature as far as expediency will permit.

OUR WAR INTEREST A PROFITABLE INVESTMENT.

RECOVERY from the shock produced by Britain's declaration of war against Germany and Austria induced our business interests to at once set about instilling into the minds of their employees and the public generally the instruction to become oblivious of the conflict of nations and pursue their multifarious avocations with peace-time regularity and assiduousness. Under the then circumstances the propaganda was timely and the best possible. Nobody of even moderate intelligence, however, looked for any practical and lasting results, and the most that could then or can now be said in favor of the action taken is that it did produce in some degree the desired effect.

In spite of the fact then that it was well nigh impossible to banish war development interest, and that a well meaning attempt thereto was made, we have to-day not only become involved in a mental sense, easily transcending our initial display, but are engaged, to the almost total exclusion of every other consideration, in the practical work of "seeing the thing through" in a real Empire patriotism sense. When we say that Canada, agriculturally and industrially is devoting herself exclusively to the work of aiding Britain and her Allies to bring the war to its one and only desirable conclusion, we mean that our Dominion in its every feature is so committed. Other than for our own immediate needs, production is relative to the war requirements of our own, the Imperial and Allied Governments.

Agriculture over the length and breadth of our land has been stimulated as at no time previous in our history, and taking account of the prices ruling for the fruits of the soil, it needs no stretch of imagination to assume that given seasonable weather for the ensuing five months, even irrespective of bumper receipts by our farmers, railroad and steamship companies, and through them to our industries generally, a foundation will have been laid, both systematically and scientifically, from which hitherto undreamed of achievement and possibilities will arise.

Again, what is true of agriculture is equally so of industry relative to manufacturing. For other than war requirements our factories are doing little, and in no section is this more noticeable than in that of our shipyards, machine tool and general engineering works. The way in which those who direct our engineering and steel production enterprises have grasped the opporunity afforded by the war, and are making good on the more or less accurate workmanship and material quality output called for by the shell specifications, leads us to conclude that greater commercial achievement and possibilities are in future store for these particular concerns.

The net result to our iron and steel industries, railroads, lake and ocean commerce will be to stimulate a desire to develop a higher degree achievement in all of these spheres, and to inspire us with a more realistic conception of our resources and capabilities than would have been possible without this war-engendered awakening.

MARINE NEWS FROM EVERY SOURCE

Ottawa, Ont.—The sum of $30,000 has been appropriated for the purchase of a new vessel for protecting fisheries on Lake Erie.

Port Arthur, Ont.—The Western Drydock & Shipbuilding Co., of this city is filling an order for 15,000 shrapnel shells for the Imperial Government.

Montreal, Que.—Specifications are now being prepared and tenders will shortly be called for the construction of a new ferry boat for the St. Helen's Island service. The city proposes to operate the ferry service.

Sarnia, Ont.—The flagship Noronic, which has been undergoing a few changes at Lorain, Ohio, has been completed and will be back to this port in time to fit out for her first trip, which it is expected will be in June.

Kingston, Ont.—The Davis Dry Dock Co. have started to build a passenger steamer for the Severn Rivers and Lake Couchiching Navigation Co. The craft will be 70 ft. long, 12 ft. beam and 5 ft. deep, and will be built of white oak.

Quebec, Que.—G. T. Davie & Sons, Levis, have secured a contract from the United States Government for the construction of twenty motor boats, each of which is to be seventy-five feet in length. The boats will be constructed in the company's yards at Lauzon.

Amherstburg, Ont.—Under a new ruling of the Canadian Department of Marine and Fisheries, Canadian fishing tugs on Lake Erie are being numbered and the names of fishing firms are being placed on buoys marking the territory of each to facilitate supervision by Government patrol boats.

"Scottish Hero" a Coaster.—The Scottish Hero, the largest of the turret class on the upper lakes, has gone to Ashtabula, where she will be cut in two and towed to the coast, to operate on a three-year charter. It is just ten years since she arrived on the upper lakes, having been brought out from England, cut in two at Levis and towed to Buffalo, where she was riveted up again, and has plied on the upper lakes continuously since.

Montreal, Que.—The passenger and general cargo service of the Black Diamond Steamship Line, which the Dominion Coal Co. has operated for many years between the ports of Montreal, Prince Edward Island, Sydney and St. John's, Nfld., will be discontinued, according to a statement made recently at the head offices of the company in this city.

Montreal-Longueuil Ferry.—The new steamer Louis Philippe, specially built for the Longueuil service by the Canada Steamship Lines, is to be placed on the route shortly after the opening of navigation, replacing the steamer Longueuil. It is expected that the new steamer will materially shorten the time between Longueuil and Montreal, and will prove a boon to the Longueuil public.

S.S. Metagama Trials.—Danger from submarines did not deter the C. P. R. liner Metagama from carrying out her trials on March 2, on the Firth of Clyde. The large party aboard for the occasion included Major Maitland Kersey, manager of ocean services, G. McL. Brown, European manager, Thos. McNeil, Liverpool agent, H. S. Carmichael, general passenger agent at London, Sir John Biles, and Captains Christie and Martin of the Allan Line. The trial was successful in every way, the new liner attaining a speed of 17½ knots an hour.

Action Against the "Lingan."—As a result of the sinking of the Canadian Government steamer Montmagny, in the Beaujeu channel, St. Lawrence river, on the morning of September 18, 1914, with the loss of 14 lives, action has been begun by his Majesty the King against the steamer Lingan, for $400,000 damages. The plaintiff alleges that the Lingan crossed over into the Montmagny's water and caused the fatal collision, that no officer was on duty on the Lingan at the time, and that there was not a sufficient watch. The case will come before Mr. Justice Dunlop, of the Exchequer court at Montreal, on May 18.

Drawback on Ship Construction Material.—An Order-in-Council has been passed to the effect that, in the payment of drawback on material used in the construction of ships and vessels, the certificate of the following societies may be accepted in determining the class of vessel for drawback purposes: Committee of Lloyd's Register and Foreign Shipping, British Corporation for Survey and Registry of Shipping, Bureau Veritas and Norwegian Veritas. The certificate of a Dominion hull inspector that the vessel has been so constructed as to fulfil the requirements of any of these societies will also be accepted.

Toronto Harbor Improvements.—The Harbor Board have notified the Board of Control that they wish to commence the reclamation of park lands on the Island and on the western waterfront at a cost of $407,862, the interest of which, amounting to $24,471, will have to be met by the city. For the season the Harbor Board propose to reclaim, by dredging, a certain amount of land lying to the east and west of Ward's Island for the purpose of furnishing additional camping ground. This will entail the pumping of 103,508 cubic yards of material. Immediately west of Ward's Island another area is to be reclaimed, and to get the proper elevation 654,013 cubic yards of material will have to be pumped.

Salvage Co. Award. — Hon. Judge Routhier, in the Admiralty Court, sitting at Quebec, rendered judgment on March 22, in the action of the Canadian Salvage Co., against the Aetna Western and other insurance companies for salvage on the 251 silver bars recovered from the wreck of the Empress of Ireland. Judge Routhier in rendering judgment awarded the Salvage Company the sum of $22,685 salvage and $36,172 additional for expenses attached to the recovery of the bars. Besides being awarded the above sums by Hon. Judge Routhier, $10,000 was also received from the Post Office Department for the salvage of the mails from the wrecked Empress. In addition the sum of $25,000 was paid the Canadian Salvage Company by the C. P. R. for the recovery of the purser's strong box.

New Canadian Train Ferry.—A new ice-breaking train ferry for the Strait of Canso service, between the Nova

Scotia mainland and Cape Breton, was launched on the Tyne on April 13 from the Armstrong, Whitworth Co. yards. Lady Drummond, of Montreal, in christening the vessel Scotia II., made a happy speech. Ships were always referred to by the feminine pronoun, she said, and this was a compliment to the sex, as ships played an important part in linking and consolidating the Empire. The women of the Dominion which the vessel was to serve were in like manner doing their part in serving the interests of the Empire. The Scotia is 300 feet long over all, 20 feet in depth molded, and having a draft of 14 feet. She is of 3,850 tons displacement. Her contract speed is 10¼ knots, and she has double sets of triple expansion engines.

Sarnia, Ont.—The steamer Matoa is in the Reid dock, being cut in two in order to be able to go through the Welland Canal, and from thence to the Pacific Coast, where she will be remodeled.

ST. LAWRENCE PILOTS.

IN view of the fact that an ocean vessel will probably make the trip to Montreal about April 24th, according to an estimate made by Captain Bourassa, harbormaster, shipping men and marine insurance companies are awaiting with interest the new regulations regarding the experience and the appointment of pilots for the district above Quebec. These interests have for a long time made representations that pilots on vessels between Quebec and the sea should have seagoing experience, and that their appointment should be conditional on their having a master's or mate's certificate.

Until an Act passed on June 12 of last year vested the administration of this district in the Minister of Marine and Fisheries, the real pilotage authorities had been the Corporation of Pilots, whose abolition had been recommended in the report of the Royal Commission appointed to report upon the law respecting pilotage and its administration in the pilotage districts of Montreal and Quebec, with suggestions as to desirable changes.

This being the first season with the Quebec pilots wholly under the Minister of Marine and Fisheries, whose initiative in establishing the change is greatly applauded by the steamship companies, it is expected that there will be some changes, although not very drastic ones. The change which has been advocated is that every apprentice pilot shall serve an apprenticeship of at least seven years on vessels engaged in the ocean or coasting trade of Canada, of which four seasons of navigation shall have been spent on vessels sailing to or from, or in transit through, the pilotage district of and below the harbor of Quebec.

All that is now required of apprentices is that they should accompany pilots backwards and forwards on their trips for a term of years, not learning seamanship as they would at sea, nor anything about the different kinds of steering gears, nor anything except what they pick up casually about the art of navigation. The shipping companies interested in getting pilots with experience at sea have offered to take new apprentices, and to see that they learn everything that would be of use to them concerning the navigation of a vessel. They feel that the large number of accidents which have occurred below Quebec as the result of poor judgment on the part of pilots demands a new system.

Respect is shown in the new suggestions for the vocation of the present pilots, and the twenty-six who are now bound as apprentices. It is only asked that the system shall change, so that the new pilot apprentices admitted after seven years of apprenticeship at sea will bring a different type of pilot into the service. In most of the British ports, no pilot is appointed unless he has had a sea-going experience and a master's certificate.

ANNUAL REPORT OF MONTREAL HARBOR COMMISSION.

STRIKING illustration of the rapidly-growing importance of the port of Montreal is contained in the annual report of the Harbor Commissioners, recently issued. The attractive book, illustrated by half-tones, and containing a fine panoramic view of the harbor as well as a colored detail map, conveys the information that, in spite of conditions caused by the declaration of war, the records of all previous years were broken. While the outbreak of hostilities caused the vessels of several lines to be requisitioned by the Dominion and Imperial Governments, and other services automatically ceased, 96 more vessels arrived than in the previous season, and tonnage of ocean and inland ships showed an increase of 650,455 tons.

Further Development Imperative.

In connection with this showing, the commissioners take occasion to call attention to the imperative necessity of still further expansion of facilities in the following paragraphs:

"With such an expansion or increase in tonnage as is shown in the following statement of the shipping of the port, it is hardly necessary to emphasize the necessity of building, with all vigor, additional berthing accommodation to keep pace with the continual increase of shipping demands:—1895, 2,013,103 tons; 1900, 3,000,000 tons; 1905, 4,725,607 tons; 1910, 6,561,021 tons; 1914, 9,044,457 tons.

"Every American port is getting ready to cope with the trade resulting from the natural growth of world commerce, consequent upon the normal increase of population and potentially from the large amount of entirely new business which inevitably will result from the opening of the Panama Canal. No sentiment is attached to the distribution of trade. If natural and artificial advantages are sufficient, if freight rates are favorable and suitable, if wharfage accommodation can be had, one port is absolutely as good as another in the eyes of the practical steamship manager. Montreal has the natural advantages, enjoys a very substantial preferential inland water and railroad freight rate over most of her rivals, and only the lack of accommodation will prevent her from reaping a large reward in the growth of her trade."

Sending War Supplies.

Of operations undertaken, especially in connection with war conditions, the report says:

"Immediately after the outbreak of the war, the commissioners devoted considerable time and attention to facilitating the forwarding of supplies to the Mother Country and to the Allies, as well as the Belgian relief gifts.

"Fortunately, the new sheds, Nos. 24 and 25, were approaching completion, and were forthwith placed at the disposal of the Government for the pressing and shipping of hay, which was carried on day and night. A railway yard and special railway tracks were immediately installed to facilitate the quick despatch of the same. During the season of navigation the hay was pressed and loaded directly into ships alongside the sheds. Since the closing of navigation, the hay is taken as it comes from the farmers, pressed and loaded into cars on the other side of the sheds and shipped directly to the Canadian winter ports.

"At the present time, hay, compressed from the farmer's bale of 18 cubic feet to the shipping bale of 6 cubic feet, is being shipped to the seat of war at the rate of 20 or 30 cars daily. The advantageous sale of this hay, the work of compressing, the switching in and the switching out, are all of great benefit to the Montreal community. The immense gifts of flour from Canada and foodstuffs from the various provinces, horses and other supplies were shipped through the sheds of the various steamship lines, taxing their capacity to the utmost.

"These most important features of the season's record resulting from the changes due to the war, commencing at

mid-summer, caused no little congestion and anxiety. Harbor and trade conditions were suddenly changed. Shipping programmes were wiped out and freight contracts upset. Until the silent but effective command of the seas was assured, business in the harbor was greatly disturbed. Fortunately, however, the measures taken to restore trade were so speedily effected and so successful that shipping immediately recommenced and, largely owing to the adaptive facilities in the port of Montreal, the required changes to meet new conditions of shipping and business were speedily made."

European Ports.

The first 50 pages of the book are devoted to an interesting summary of the study of development of harbor facilities in Europe made during February, March and April, 1914, by the president, W. G. Ross; the chief engineer, F. W. Cowie, and the assistant secretary, M. P. Fennell, jun. The delegation inspected harbor works at London, Liverpool, Havre, Marseilles, Genoa, Hamburg, Rotterdam, Antwerp, Bristol, Manchester, Glasgow, Edinburgh, Rosyth, Hull and Southampton, and gathered valuable information, including maps and charts of all the harbors named, and construction plans and details of each.

With a season of navigation of seven months, as against twelve months at the other ports, Montreal handled exports of 75,085,432 bushels of wheat, compared with 64,532,190 bushels handled at New York, 45,000,000 bushels at Baltimore, and 16,555,340 at Boston.

Few persons would imagine that tariffs in Montreal for storage and handling of grain would be less than half those of the port of London, but such is the case. The commission found that in London all construction costs, both material and labor, were lower, and operating costs, such as wages and supplies, were cheaper. The only item cheaper in Montreal was power. Nevertheless, the Montreal tariff for shoveling, weighing, storage for 20 days, weighing and delivering by conveyors to ocean ships is only 8-10 of a cent per bushel, while in London, with delivery within 14 days, it is 2 4-5 cents per bushel.

Only eleven German ships arrived at the port during the year, against 769 British vessels. The country whose flag was most often represented, exclusive of Britain, was Norway, which sent 113 ships to Montreal during the season.

The Year's Finances.

The total amount received on revenue account for the year 1914 was $1,466,364, being an increase of $104,400 over the previous year, the larger portion of which increase is attributable to the operation of grain elevators Nos. 1 and 2.

The disbursements on revenue account in 1914 were $1,459,455, of which $758,642 was for interest, being an increase in disbursements of $133,818 over the previous year.

There was received from the Dominion Government on loan $2,032,000, on account of expenditure on capital account, and also the sum of $200,000 to retire debentures, Series "C," held by the public.

The disbursements on capital account in 1914 were $1,758,368. The cost of the principal works of improvement carried out are as follows:

Harbor dredging	$299,808
Real estate	39,469
Wharves, piers and basins	745,062
Plant	83,663
Shops and buildings	24,573
Railways	115,236
Permanent sheds	345,246
Electric hoists, etc.	31,878
Grain elevators	143,431

The debenture debt of the corporation on the 31st December, 1914, was $23,554,000, of which $1,472,000 is to the public, and $22,082,000 to the Dominion Government. The average rate of interest on these debentures is 3.344 per cent.

CAUSES OF SHIPPING LOSSES.

A PAPER on "Ship Casualties" was read recently before the Liverpool Engineering Society by W. S. Abell. The contents of the paper were confined to an analysis of the losses of vessels registered in the United Kingdom which either foundered or were missing between July, 1899, and June, 1913, a period of fourteen complete years. In this period, 208 steamers of and over 100 tons gross, registered in the United Kingdom, were reported to have foundered or to be missing.

A table was given showing the percentage annual losses of vessels from which it appeared that the losses of vessels, between 100 and 1,000 tons gross were considerably less than those of 1,000 tons and upwards, the relative percentages being 0.172 and 0.212, a result which was attributed to the greater opportunities for shelter which the coasting and home trade offers. The table also demonstrated that for very small vessels, 200 tons gross and below, and for large vessels, say, over 4,000 tons gross, the casualty was very small. Between these limits there was a curious variation reaching a maximum at two points, viz., between 400 and 1,000 tons gross, and also between 2,000 and 3,000 tons gross. No adequate reason appeared from any of the analyses made for these remarkable variations, nor had it been possible to conjecture any possibility for such vagaries.

In vessels of small size, namely, 1,000 tons gross and under, the average age of lost vessels was about thirteen years, while 35 per cent. of all losses occurred in vessels whose age was five years or under. With large vessels the rate of loss was on the whole regular and independent of age, but between the ages of twelve and eighteen years the loss was practically double that of following years and 50 per cent. above the average loss for the whole thirty years. Another table presented by the author showed that 75 per cent. of all losses occurred in the winter months from October to March.

Loss Causes Grouped.

The author divided the cause of loss into two main groups. "The first group comprises all cases in which damage is sustained, which shows itself in the form of leaks, of hatchways being damaged, of ventilators and machinery casings being carried away, and what is sometimes very vaguely termed, stress of weather. The second group comprises all cases in which the loading of the vessel may be in question, either by shifting of the cargo in holds and on deck, and by what is termed improper loading. Improper loading is somewhat indefinite, but as generally understood it refers to cases of what is judged to be insufficient stability, owing to the centre of gravity of the loading being too high. It was pointed out that there is some slight overlapping of an unknown amount between the two groups, because damage may arise from shifting of cargo. As far as possible, however, the actual overlapping has been reduced to a minimum.

"It was shown that twice as many losses occur from damage as arise from questions of loading, and this result is not altogether unexpected. The losses from leaks are much the most numerous, averaging some 40 per cent. of the total, and being greater in large vessels, probably owing to the closer proximity of small vessels to land. Damage to deck openings and casings is much greater in large vessels, and this fact would naturally be expected owing to the greater risks experienced in deep-sea trading.

"The losses arising from shifting of cargo are practically the same in large and small vessels. On the other hand, the losses due to improper loading are eight times as great in the large vessels; this is a striking feature of the analysis. As regards group totals, the losses due to damage are considerably less in small vessels. The losses due to what may be called errors in loading are much the greater in vessels of 1,000 tons gross and under, this excess being entirely due to improper loading of vessels."

We are indebted to the "Engineer," London, England, for the foregoing synopsis of Mr. Abell's paper.

ASSOCIATION AND PERSONAL

A Monthly Record of Current Association News and of Individuals
Who Have Been More or Less Prominent in Marine Circles

Captain Malcolm McLeod, former harbormaster of Vancouver, B.C., is dead at the advanced age of 80.

J. W. Churchill, a pioneer of shipbuilding in Nova Scotia, died at Windsor, N.S., on April 10.

J. S. Byrom has been appointed superintendent of the C. P. R. Great Lakes steamship service, with headquarters at Port McNichol. Ont.

Sam Buchanan, who for the past twelve years has been superintendent of the Upper Lake Division of the C. P. R. steamship service, will retire from active service on May 1st.

Jas. H. Ronan, for many years connected with the staff of the Northwest Transportation Co., and later with the Northern Navigation Co., died at his rome in Sarnia, Ont., on April 12, aged 56.

Ralph Hewson, assistant engineer, Toronto Harbor Commissioners, has left for St. John, N.B., to join the Canadian Pacific Overseas Construction Corps which leaves for France early next month.

Captain R. P. Boyle, of the steamer J. Frater Taylor, which arrived at Fort William on April 20, was presented with the customary silk hat by the Fort William Board of Trade for being the first master to bring his ship into this port this year.

H. B. Smith, of Owen Sound, was re-elected president of the Northern Navigation Co., at the annual meeting of the company held at Montreal on April 1 last. Mr. Smith was also re-elected as a director of the Canada Steamship Lines, Itd., of which the Northern Navigation Co. is a subsidiary company.

William Burrill, of the firm of William Burrill & Co., Yarmouth, N.S., died there on Friday morning, March 26 aged 74 years. Mr. Burrill was a native of Yarmouth, and, in the days when ship building in Nova Scotia was active, he and his firm were indentified with the industry, many fine craft being constructed in their shipyards at Meteghan and along the coast. Latterly the firm has been engaged in ship chandlery and outfitting business.

James Currie, marine engineer of 71 McGill street, Toronto, died on March 31. Mr. Currie was the son of James Currie, sr., who, with his brother, Neil, founded the Currie Boiler Works, now known as the Polson Iron Works. He was born Feb. 6, 1852, at Dundas, Ont., but came to Toronto when very young, practically all his life having been spent here. Mr. Currie was a member of the Marine Engineers' Association.

Captain Robert H. McKay, who saw the building of old Fort Henry, opposite Kingston, in the early thirties, and who witnessed the execution on the gallows of the rebel leader, Von Shultz, in the fort in 1838, died at Kingston, Ont., on April 17, aged ninety-one years and eleven months. His grandfather was a ship carpenter in the British navy, and came to the old navy yard at Point Frederick to help build warships for the war of 1812. Captain McKay sailed on the Great Lakes for years.

LICENSED PILOTS.

ST. LAWRENCE RIVER.

Captain Walter Collins, 43 Main Street, Kingston, Ont.; Captain M. McDonald, River Hotel, Kingston, Ont.; Captain Charles J. Martin, 13 Balaclava Street, Kingston, Ont.; Captain T. J. Murphy, 11 William Street, Kingston, Ont.

ST. LAWRENCE RIVER, BAY OF QUINTE, AND MURRAY CANAL.

Captain James Murray, 106 Clergy Street, Kingston, Ont.; Capt. James H. Martin, 259 Johnston Street, Kingston, Ont.; John Corkery, 17 Rideau Street, Kingston, Ont.; Captain Daniel H. Mills, 272 University Avenue, Kingston, Ont.

ASSOCIATIONS

DOMINION MARINE ASSOCIATION.

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GREAT LAKES AND ST. LAWRENCE RIVER RATE COMMITTEE.

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INTERNATIONAL WATER LINES PASSENGER ASSOCIATION.

President—O. H. Taylor, New York.
Secretary—M. R. Nelson, 1184 Broadway, New York.

THE SHIPPING FEDERATION OF CANADA

President—Andrew A. Allan, Montreal; **Manager and Secretary**—T. Robb, 218 Board of Trade, Montreal; **Treasurer**, J. R. Binning, Montreal.

GRAND COUNCIL, N.A.M.E. OFFICERS.

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A. F. Hamelin, Montreal, Que., Grand Vice-President.
Neil J. Morrison, P. O. Box 238, St. John, N.B., Grand Secretary-Treasurer.
E. Read, Vancouver, B.C., Grand Conductor.
A. J. Ross, Halifax, N.S., Grand Doorkeeper.
James Gillie and A. E. Kennedy, Kingston, Ont., Grand Auditors.

CLYDE SHIPBUILDING.

CLYDE shipbuilders launched, during March, twelve mercantile vessels of an aggregate gross tonnage of 43,100, as compared with ten vessels of 42,300 tons in the preceding month, and 15 vessels of 23,700 tons (excluding warship tonnage) in March of last year. The total for the first three months of 1915 now reaches 29 merchant ships of 106,700 tons, as against 43 mercantile vessels of

1915 Directory of Subordinate Councils, National Association of Marine Engineers.

Name.	No.	President.	Address.	Secretary.	Address.
Toronto,	1	Chas. M. Arnott.	94 Hanley Street.	J. S. Adams	631 Gladstone Ave., Toronto.
St. John,	2	G. J. McVicar	49 Winslow St. West.	G. T. G. Blewett,	36 Murray St., St. John, N.B.
Collingwood,	3	W. T. Rennie,	Collingwood,	Robert McQuade,	P. O. Box 97, Collingwood.
Kingston,	4	E. Spence	Kingston	James Gillie,	101 Clergy St., Kingston, Ont.
Montreal,	5	A. F. Hamelin,	3210 Le Tang Street,	O. L. Marchand,	2378 Clark St., St. Vincent de Paul, P.Q.
Victoria,	6	John E. Jeffcott,	Esquimault,	Peter Gordon,	808 Blanchard St., Victoria, B.C.
Vancouver,	7	W. G. Wooster,		E. Read,	Room 8, Jones Bldg., Vancouver, B.C.
Levis,	8	Michael Latulippe,	Lauzon,	S. G. Guenard,	Bienville, Levis, P.Q.
Sorel,	9	John Matte,	Sorel,	Al. Charbonneau,	P. O. Box 132, Sorel, P.Qa.
Owen Sound,	10	Wallace Robertson,	1030 4th Ave. West,	James Nicoll,	714 4th Ave., Owen Sound, Ont.
Windsor,	11	Alex. McDonald,	28 Crawford Ave.	Neil Maitland,	221 London St., W., Windsor, Ont.
Midland,	12	George Wilson	Midland,	Roy N. Smith	
Halifax,	13	Robt. Blair,	29 Preston Street,	Chas. E. Pearce,	Portland St., Dartmouth, N.S.
Sault Ste. Marl	14	A. E. Lewis.	Box 563, Soo, Gnt.,	Geo. S. Biggar,	43 Grosvenor Ave., Sault Ste Marie.
Charlottetown,	15	J. F. McGuigan,	38 Queen Street,	Lem Winchester,	302 Fitzroy St., Charlottetown, P.E.I.
Twin City,	16	Harry Cross,		Lloyd Williams,	142 Secord St., Fort William, Ont.

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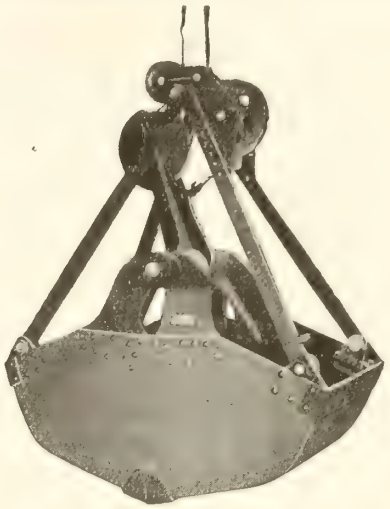

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91,500 gross tons in the first quarter of last year.

In the first three months of 1914 five warships (four destroyers and one submarine) left the stocks at Clyde yards, but no particulars can be given of the naval vessels consigned to the water during the quarter just ended. From the foregoing figures it will be observed that the mercantile tonnage so far launched this year exceeds that of the corresponding period of last year, notwithstanding the precedence now being given to naval construction.

THE BIG GUN.

WHEN it is desired to convey an idea as to the offensive capabilities of any particular warship, it is quite usual to say that the vessel has so many guns of a particular calibre. If such a method of summarizing the armament of a warship is made use of for comparative purposes, says the Liverpool Journal of Commerce, it is quite liable to lead to considerable misconception as to the actual offensive merits of the vessels compared, unless the guns are of practically the same age. The fallacy of this method of comparison, if applied generally, lies in the fact that the many improvements introduced in the art of gunnery have enabled our experts to design and produce weapons of increased power and effectiveness from time to time without altering the calibre.

This point is perhaps best illustrated by the case of the 12-in. gun, which for a number of years held pride of place as the chief offensive weapon of practically all the navies of the world. The 12-in. gun is by no means a recent introduction, it being of historical interest to note that, at the bombardment of Alexandria, H.M.S. Monarch carried four weapons of this calibre. These guns were of the rifled muzzle-loading type, and weighed 25 tons apiece. The projectile weighed 608 lbs., and it was fired by a charge of pebble powder of 85 lbs. weight. This gun cannot, of course, be compared with the modern weapon, nor can it be claimed that it was representative of the type.

First Modern Type 12-in. Gun.

The first modern type 12-in. gun superseded the previous weapons about 1882, and its conception and rapid development were brought about by the introduction of new methods of construction and various important improvements in the nature and character of the powder. The various stages of progress were denoted by giving each class of gun a distinctive mark number, for example, 12-in. Mark V.

Marks III., IV., and V. were of only 30 calibres in length, and fired a 714 lbs. projectile with a muzzle-energy of 18,000 foot-tons, by means of the old prismatic brown powder. In the Mark VIII. weapon, the projectile is increased to its present weight of 850 lbs. This weapon is 35 calibres in length, and develops a muzzle-energy of 33,000 foot-tons. Mark IX. is a 50-ton gun of 40 calibres, having a muzzle-energy of 36,000 foot-tons; while the Mark X. 12-in. gun of 45 calibres weighs 58 tons and develops a muzzle-energy of 48,000 foot-tons. The last gun of this size, namely, the 50-calibre gun, developed 53,400 foot-tons muzzle-energy. The improvements attained in the later types can probably be best illustrated by comparing the penetrative power of each in inches of Krupp's steel with an uncapped shell at 3,000 yards. These figures are given in the following table:—

12 in. Mark VIII.	11½ in.
„ IX.	12½ in.
„	„ —14 in. with improved cordite.
„ X.	—17 in.
Latest weapons.	—22.2 in.

From this it will be seen that the penetrative power of the 12-in. gun has been doubled in a period of years approximating to the life of a battleship.

Comparison of 12-in. and 13.5-in. Guns.

It is also of interest to compare the latest type of 12-in. gun with the earlier 13.5-in. weapon. These latter were of 45 calibre, and, consequently, the guns were of practically the same lengths. The 13.5-in. projectile weighs 1,250 lbs., and with a muzzle-energy of 63,000 foot-tons the penetration of Krupp's steel at 3,000 yards is 22.8 in. We thus see that from the point of view of penetration, there is little difference between the two weapons; but apart from other less obvious advantages, the larger gun fires a shell of nearly 50 per cent. greater weight, and consequently carries a much larger bursting charge.

Catalogues

Pocket Book and Diary.—The pocket book and diary sent us by Cammell, Laird & Co., Birkenhead, England, is in its every feature, artistic and useful, and just what might be expected of a firm whose reputation for doing all things well in their ordnance, naval and merchant vessel production is world-wide.

Flag Calendar.—We have received from the Lighthouse Literature Mission, Belfast, Ireland, a copy of their 1915 Calendar, the feature of which is an illustrated layout of the new International Code Flags. A scroll heading giving the Mission designation and setting forth its purposes, together with a neat and easily legible "tear-off" monthly date panel serve to complete a useful and highly artistic production.

Search Light Projectors made by Enberg's Electric and Mechanical Works, St. Joseph, Mich., are described fully in a bulletin recently issued. This type of projector is designed for installation in the pilot house or on deck, and the principal features of each type illustrated are dealt with. A table is included giving the principal dimensions, weights, etc., of each type.

Frank & Sons Calendar.—The 1915 calendar issued by Frank & Sons, marine and engineering photographers, South Shields, England, comprises a series of representative vessel photographs in black and white, and a monthly "tear-off" date pad pleasingly and artfully arranged. The vessels illustrated include the "Aquitania," the "City of Exeter," the "Varela," and a torpedo boat destroyer, all of them being under steam.

Thornycroft Calendar. — John I. Thornycroft & Co., Caxton House, Westminster, London, England, give evidence of the war spirit dominating all of us at the present time, and particularly the naval phase of it in their current year calendar. H.M.S. Lance, torpedo boat destroyer, ploughing through a sea, is the prominent feature, while illustrations of a motor wagon and motor boat together with a "tear-off" monthly date pad, round out an attractive and especially appropriate publication.

Generating Sets.—Enberg's Electric & Mechanical Works, St. Joseph, Mich., have sent us a copy of bulletin No. 24, describing the "Enberg" dynamos and engines. The generating sets dealt with in this bulletin are vertical, direct connected type from 2½ to 50 k.w. for marine or land purposes. A detailed description covering their construction is given accompanied by illustrations showing the details and sectional views. Tables are included giving the weights and principal dimensions of each size.

The Peninsular and Oriental Steam Navigation Co. has issued an exceedingly attractive and useful diary and almanac for 1915. The P. & O., as is well known, has a large fleet of steamers, the names of which are given, with their tonnage. Complete sailing dates for the year for the India and China mail boats are included, together with a lot of useful information for travellers going to the Far East. A number of statistical tables concerning the British Empire form interesting reading, while a series of maps show the trade routes and ports of call for the line. The diary is bound in stout buff-colored linen covers, with pockets for tickets, stamps, etc., all of which are more or less useful to travellers.

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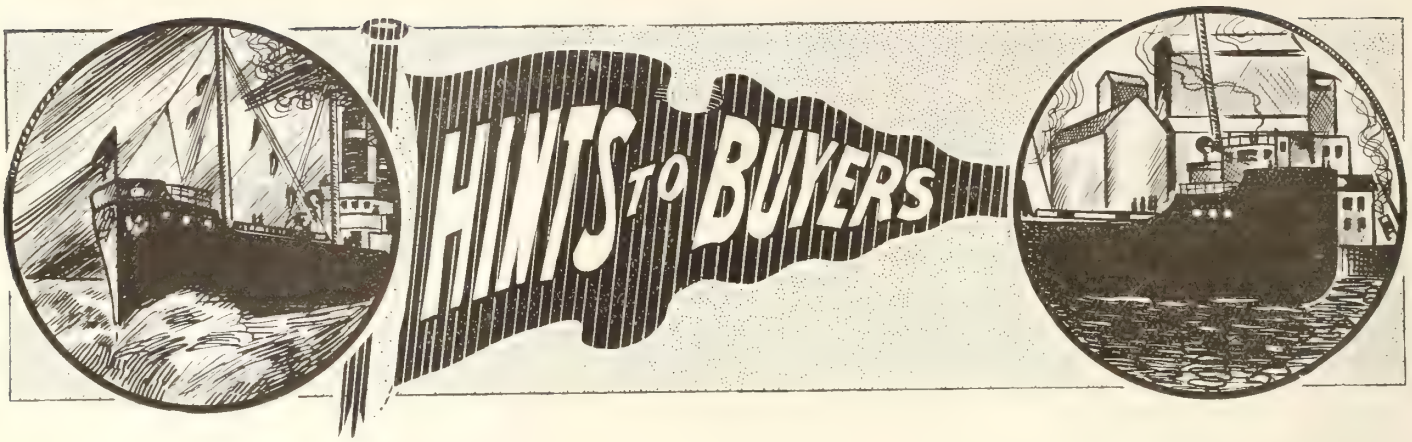

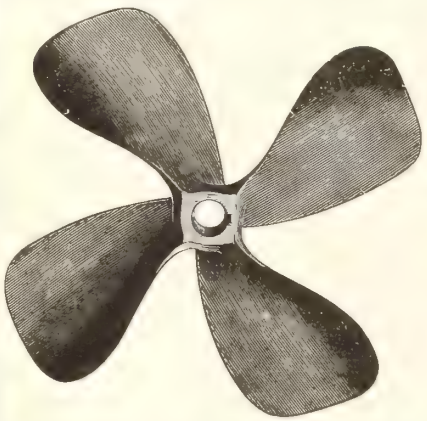

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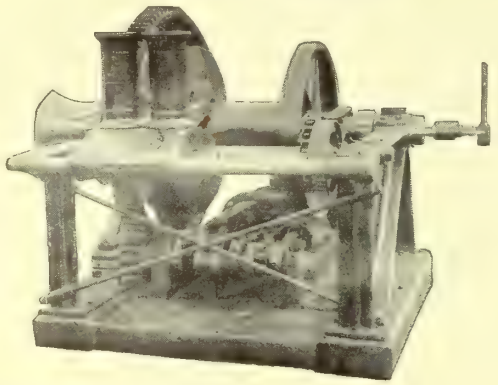

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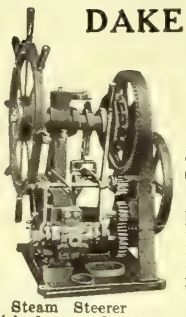

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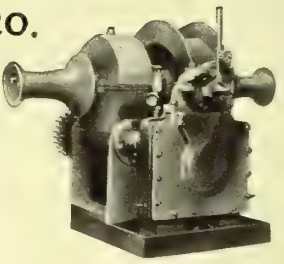

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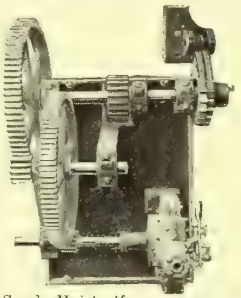

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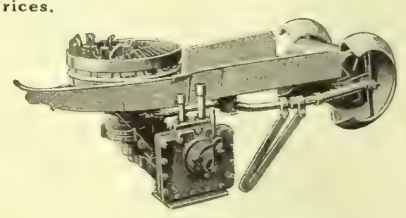

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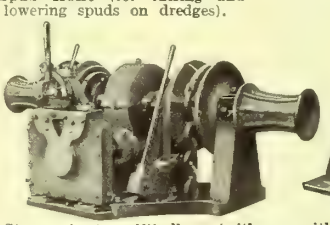

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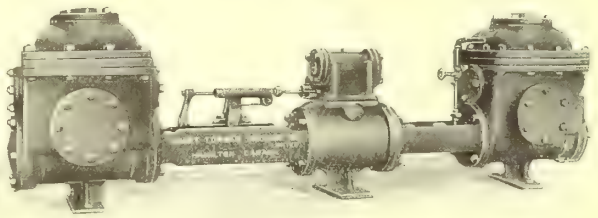

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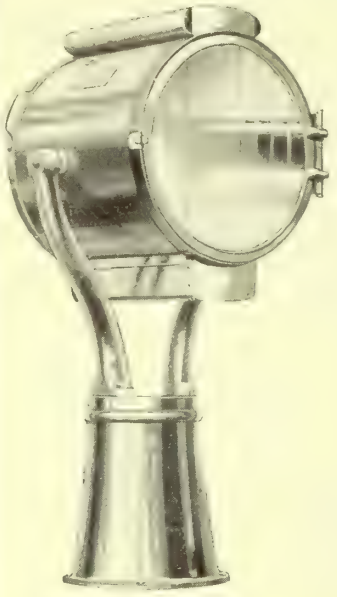

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"Empress of Ireland"-"Storstad," Admiralty Court Finding

In what follows will be found a practically complete statement of the text of the judgment and the facts and data leading up thereto in the matter of the action and counteraction for damages arising out of the collision between these vessels on May 29, last year.

IN the Exchequer Court of Canada, Quebec Admiralty District, the Hon. Mr. Justice Dunlop, D.L.J., Q.A.D., presiding, with Captain Francis Nash as Nautical Assessor, the action—Canadian Pacific Railway Co., plaintiff, vs. s.s. Storstad, defendent, was recently the subject of a quite prolonged hearing. As in the case of the "Mersey" inquiry, blame has again been placed on the Storstad for the resulting collision.

The plaintiff, as the owner of the s.s. Empress of Ireland, claimed the sum of three million dollars against the ship Storstad for the loss of the s.s. Empress of Ireland and the amounts paid or that may hereafter be paid for loss of life or personal injury to members of the crew or others, whether under the Workmen's Compensation Act or otherwise, and for other and all losses and damages occasioned by the collision which took place in the St. Lawrence River, near Father Point, on the 29th May, 1914, and for costs.

Plaintiff's Claim.

Whereas the plaintiff, by its statement for claim, alleges as follows:

1.—That between 1.45 and 2 o'clock a.m. on the 29th May, 1914, the SS. Empress of Ireland, 8,028 net registered tonnage, of which the plaintiff is the owner, whilst on a voyage from Quebec to Liverpool, with passengers and general cargo, was between six and seven miles to the northward and eastward at Father Point, which is on the south shore of the River St. Lawrence.

2.—There was a fog and no wind and the tide was about half flood, although there remained a current down stream running at the rate of about one and a half knots.

3.—The Empress of Ireland had dropped her pilot near the Father Point gas buoy, and had then got under way, taking a course of N. 47° E. magnetic, until she had the Cock Point gas buoy abeam, when the course was changed to N. 73° E. Magnetic.

4.—That the lights of another ship which turned out to be the Storstad, were first seen several miles off before the fog shut in, and bearing at first about four points on the starboard bow of the Empress of Ireland; but when the latter altered her course, off Cock Point buoy, the Storstad's lights bore about a point or a point and a half on the starboard bow of the Empress of Ireland, and the vessels would have passed each other starboard to starboard, at a safe distance, if the Storstad had not subsequently altered her course in the fog.

5.—There had been intermittent fog earlier in the night, but the weather was clear when the Empress of Ireland left Father Point, and it was somewhat later, a little after altering the course off Cock Point buoy, that fog coming from the south shore was seen to be dimming the Storstad's lights; the Empress of Ireland was duly exhibiting the regulation lights for a steamship under way.

6.—That, seeing said fog, the engines of the Empress of Ireland were reversed full speed and her whistles blown three short blasts, which signal was a few minutes later repeated. When the Empress was stopped in the water, her engines were stopped and two long blasts were twice sounded on her whistle. When the lights of the Storstad were seen coming out of the fog, the master of the Empress hailed the Storstad to go astern and in the hope of avoiding or minimizing the effect of a collision, the engines of the Empress were ordered full speed ahead and her helm hard-a-port.

7.—Nevertheless, the Storstad came on at a considerable speed and the Storstad's stem struck the starboard side of the Empress of Ireland about amidships, causing her to sink soon after.

9.—That the helm of the Storstad was improperly ported.

10.—That the Storstad failed to keep her course and pass the Empress of Ireland starboard to starboard.

11.—That the Storstad was navigated at an immoderate rate of speed.

12.—That those in charge of the Storstad failed to reduce her speed and sound her fog signals before she ran into the fog.

13.—That the engines of the Storstad were not in due time slowed, stopped or reversed.

14.—That no competent officers were on duty on the Storstad.

15.—That those in charge of the Storstad neglected to comply with articles 16, 27 and 29 of the International Rules

C.P.R. PACIFIC COAST STEAMSHIP "PRINCESS IRENE, BLOWN TO ATOMS IN SHERNESS HARBOR ON MAY 27. THIS VESSEL, ALONG WITH HER SISTER SHIP THE "PRINCESS MARGARET," WERE BUILT BY WM. DENNY BROS., DUMBARTON, SCOTLAND, AND BOTH WENT INTO COMMISSION TOWARDS THE LATTER PART OF 1914 ON BRITISH ADMIRALTY SERVICE.

of the Road in force in Canadian waters, and plaintiff claims:—

(1)—A declaration that it is entitled to the damage proceeded for.

(2)—The condemnation of the defendant and its bail in such damage and costs.

(3)—To have an account taken of such damage with the assistance of merchants.

(4)—Such other and further relief as the nature of the case may require.

Defendant's Answer.

The defendant, by its statement of defence and counter-claim, alleges in substance the following:

1.—That except as hereinafter admitted, the several statements contained in the plaintiff's statement of claim are denied.

2.—The defendant is owner of the Norwegian steamship "Storstad" of 6,028 gross tonnage.

3.—That at about 2 a.m. on the 29th May, 1914, the Storstad, while on a voyage from Sydney, Cape Breton, to Montreal, with a cargo of coal, came into collision with the Empress of Ireland at a point about seven miles to the northward and eastward of Father Point, in the River St. Lawrence.

4.—The Storstad, proceeding up the river, passed Metis Point at about 12.35 a.m. There was no wind; the tide was flood, but in spite of the tide, there was a current setting down the river at the speed of between one and two knots. The Storstad left Metis Point about three miles off and proceeded on a course west one-quarter south magnetic, for a distance, measured by patent log, of six miles, and then on a course of west of one-half south magnetic for a distance measured by patent log, of five miles; and thence on a course of west by south magnetic, which course she held until the collision.

5.—That at about the time when the Storstad changed her course to west by south, those in charge of her sighted the masthead lights of a steamer, which proved to be the Empress of Ireland; the lights were several miles away and were on the port bow of the Storstad. As the vessels proceeded, those on board the Storstad saw the green light of the Empress still on the Storstad's port bow. Shortly afterwards the Empress changed her course, so that in addition to her masthead lights her red light was visible to those on the Storstad and her green light was shut out. The vessels were then two miles away and the Empress was a point or more on the Storstad's port bow.

6.—That shortly after a bank of fog, which had been moving out from the southern shore of the river, dimmed and finally shut out the lights of the Empress. The Storstad's engines were at once slowed and, about two minutes later, when the fog bank enveloped the Storstad also, her engines were stopped.

7.—That four or five minutes after the Storstad's engines had been stopped, her wheel was ported in order to prevent the current from swinging her head to port and in the direction of the Empress and in order thus to insure ample space for clearance. The Storstad did not swing under the port wheel since her steerage way was lost, or nearly so. The engines of the Storstad were then ordered slow ahead, because it was desirable to preserve steerage way, and immediately thereafter the green light and masthead lights of the Empress were seen on the Storstad's port bow, moving across her bow.

The Storstad's engines were at once put full speed astern and kept so until the collision. The stem and the bluff of the starboard bow of the Storstad struck the starboard side of the Empress about amidship, the vessels at the moment of the contact, forming an angle of about 3½ points. The Empress continued to go ahead across the bow of the Storstad which was swung around in the direction of the Empress' movement.

As soon as the vessels touched, the Storstad's engines were ordered ahead, for the purpose of keeping her stem in the wound, but the headway of the Empress caused the vessels to seperate. At the time the vessels came together, the Storstad was still heading west by south.

8.—That as soon as the fog set in, fog whistles of one long blast were blown by the Empress and were answered by the Storstad. Shortly thereafter, two signals of three whistles each were heard from the Empress; all the Empress's whistles sounded on the Storstad's port bow. The Storstad so long as she retained headway, continued to blow fog signals, but when it was found that she had lost steerage way, a signal of two long blasts was sounded on her whistle. When, after the lights of the Empress were seen through the fog, the Storstad went full speed astern, a signal of three blasts was blown on her whistle.

9.—The defendant charges against plaintiff, its agents and servants, the following faults:—

(a)—In keeping a bad look out.

(b)—In that she was in charge of incompetent officers.

(c)—In attempting to cross the bow of the Storstad although the vessels, when the fog shut in, were clear to pass port to port.

(d)—In failing to hold her course and to pass the Storstad port to port.

(e)—In changing her heading and course to port in the fog.

(f)—In that, having headed across the bow of the Storstad, she put her engines full speed astern, reduced her speed, and thereby caused collision.

(g)—In that she attempted to pass the Storstad too close.

(h)—In that she failed to comply with articles 15, 16, 18, 19 and 22 of the International Rules of the Road at Sea, which were then and there in force.

(i)—In that she blew a signal of three whistles when the vessels were enveloped in fog, contrary to article 28 of the said rules.

(j)—In that she failed to indicate her position and manoeuvres by blowing proper or sufficient whistles.

10.—That no blame and resulting damage is attributable to the SS. Storstad or to any of those on board of her.

By way of counter-claim, defendant says:—That the collision has caused great damage to the defendant and to the SS. Storstad, and claims:—

1.—A declaration that the defandant is entitled to the damage asked under its counter-claim.

2.—The condemnation of the plaintiff in the damage caused to the Storstad and to defendant, and in the costs of this action.

3.—To have an account taken of such damage with the assistance of merchants.

4.—Such further and other relief as the nature of the case may require.

Mersey Commission Evidence.

Evidence in this cause is very voluminous because by consent of parties, it is agreed that all the evidence taken and exhibits filed before the commission of inquiry into the casualty of the Empress of Ireland held at Quebec on the 14th June, 1914, and following days, would be read and used as evidence to all intents and purposes as if taken in this case, the whole as appears by consent of the parties of date the 234 June, 1914, and filed the 12th August, 1914.

Under said consent, the right was reserved to each party to recall any witness examined in said inquiry and to put in further evidence, if desired, and that said agreement was made effective in all respects, in and for any class of action, counter-claim or any action or proceeding against the Empress of Ireland.

A very large amount of additional evidence was taken before this court, in Montreal, and the record is, consequently, very voluminous. The question as to who, if anyone, is to blame for the collision in this case depends largely on which of the two stories put forward by the respective owners of the respective vessels, is to be accepted. The evidence on material points is absolutely contradictory.

The main difference between the two vessels' stories is to be found in the description of the way in which the two

vessels were approaching each other at the time when the Empress of Ireland changed her course after having obtain- an offing from Father Point. Father Point is the place where the Empress of Ireland, the outward bound ship, had dropped her pilot; it is also the place where the inward bound ship, the Storstad, was to pick up her pilot. It is situated on the south side of the river.

The witnesses from the Storstad say they were approaching so as to pass red to red, while those from the Empress of Ireland say they were approaching so as to pass green to green. I feel that I am safe in making the assertion that the Storstad never saw the red light of the Empress at any time, which can be proved by converging courses, but it is within the bounds of possibility that the Empress might have seen the green light of the Storstad at some time, and the impossibility. Now, having shown that there is a possibility of the Empress having seen the green light of the Storstad at some time, it immediately places her in the enviable position of being a passing ship instead of a crossing ship. The stories are absolutely contradictory and we have to determine which is the more probable.

Change of Course in the Fog.

The whole trend of the evidence taken at Quebec was evidently made with the purpose of establishing which of the two vessels had changed her course in the fog and this was the main question the commission had to decide.

That defendant, in opening its case, charged the plaintiff with three faults:

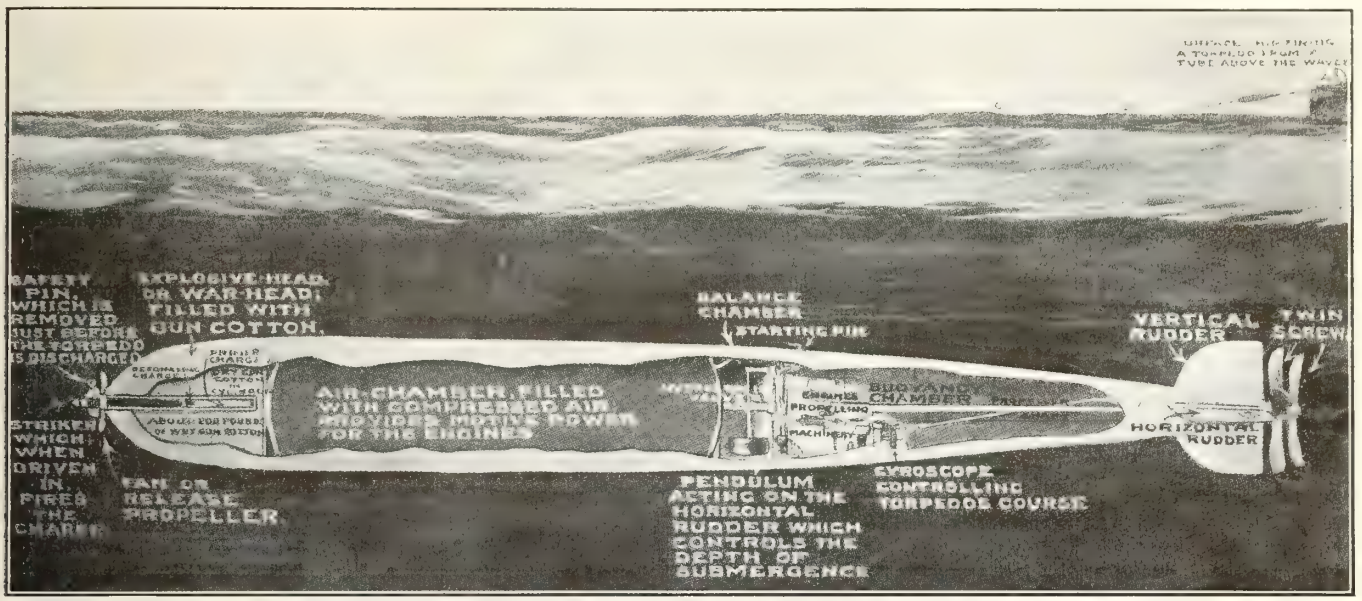
(1)—That the alteration of the Empress's course at Cock Point buoy was, according to it, a wrong thing to do.

collision or caused it, then it would be a fault.

As is well known, there is a difference between the English law and our law that used to exist and which has been very recently abolished. All the English jurisprudence is under the old law. In England, formerly, a breach of the rules was presumed to have contributed to the collision or caused it, unless the contrary was proved. In our law, the plaintiff has to prove the breach of the rule, and also that it caused or contributed to the collision.

In this particular case, either the ships were, for some minutes to the knowledge of each other, green to green, or they were, for some minutes before the collision, to the knowledge of each other, red to red, after the cock Point buoy alteration.

There is no suggestion that the ships


SAFETY PIN, WHICH IS REMOVED JUST BEFORE THE TORPEDO IS DISCHARGED
EXPLOSIVE HEAD OR WAR-HEAD, FILLED WITH GUN COTTON.
BALANCE CHAMBER
STARTING PIN
VERTICAL RUDDER
TWIN SCREW
AIR-CHAMBER, FILLED WITH COMPRESSED AIR, AND VERY HIGHLY HEATED, PROVIDES MOTIVE POWER FOR THE ENGINES
BUOYANCY CHAMBER
ENGINES
PROPELLING MACHINERY
HORIZONTAL RUDDER
STRIKER WHICH, WHEN DRIVEN IN, FIRES THE CHARGE
FAN OR RELEASE PROPELLER.
PENDULUM ACTING ON THE HORIZONTAL RUDDER WHICH CONTROLS THE DEPTH OF SUBMERGENCE
GYROSCOPE CONTROLLING TORPEDO COURSE

CHIEF WEAPON OF THE SUBMARINE—THE TORPEDO, ITSELF A SMALL AUTOMATIC SUBMARINE.

The machinery for super-heating air, which has increased the range of the torpedo to so considerable an extent, is not shown in the diagram, as it is a secret. The letters at and near the surface ship refer to the following:—A—Safety pin removed just before the torpedo is discharged. A to B—Delay action check is placed on the engine during pasage from A to point of striking water, B. At B the water turns the fan, or release-propeller. At C the fan is fully unscrewed, and the striker-rod is free to act after a small pin (a third safety-check) has been broken by the striker being driven in by impact with the object attacked. From B to C is forty feet.
—Cut and Data, Courtesy "Illustrated London News."

assessor quite agrees with me in this finding.

I am going to prove later that the Empress was stopped in a position which is indisputable, and the present position of the wreck will verify it, whereas the Storstad, having nothing to verify her position by, might have been somewhat to the south, in which case the Empress might have seen the Storstad's green light at some time. The fact that the Storstad ported her helm and ran into the Empress on the starboard side shows that the Storstad must have been somewhat to the south. So, of the two stories of green to green of the Empress, and red to red of the Storstad, the Empress has the best of the argument, as her's is a possibility, but the Storstad's is an

(2)—That the speed of the Empress was maintained until the collision took place.

(3)—The Empress of Ireland is charged with not having a proper look-out.

As to the alteration of the course at Cock Point buoy, the defendant pretends that by so doing, a risk of collision was produced. A manoeuvre is wrong if it creates a risk of collision. The test, therefore, is whether this manoeuvre created a risk of collision. A further test is again if it did not create a risk of collision, did it contribute to the disaster in question? If a given manoeuvre creates a risk of collision, it would be a breach of the rule, and if it creates a risk of collision which contributed to the

were head on or nearly head on. The ships were passing ships, each one seeing the other. Even if the ships were either red to red, or green to green, to the knowledge of each other, for some minutes before the fog, the courses were safe; there was no risk of collision at that moment.

The anterior manoeuvre had not created a risk of collision and the material and vital question is, as was stated in Quebec by everybody before the commission, which ship destroyed the safe position? The ship which altered its course was at fault. If the ships entered the fog red to red, the courses were absolutely safe. If red to red is safe, then green to green is equally safe.

I cannot see that there should be any

difference in the Empress's favor in that risk. What is true of red to red must be true of green to green, so on defendant's statement, there is nothing in the suggestion that the initial manoeuvre created a risk of collision, or otherwise created a dangerous position, or that the initial manoeuvre, in any way, caused or contributed to the collision, since the ships were each on passing courses and each knew that they were passing courses before the fog set in.

Empress Speed.

As to the second alleged fault, that the speed of the Empress of Ireland was maintained until the collision took place, I will take this into consideration when I treat of the responsibility for the accident.

As to the third alleged fault, that the Empress of Ireland had no proper lookout, this has certainly not been established, as the witness Carroll was in the crow-nest lookout and faithfully fulfilled his duty and remained there to the last moment.

The Empress Steering Gear.

It has also been charged that the Empress of Ireland changed her course not by reason of any wilful alteration of her wheel, but in consequence of some uncontrollable movement which was accounted for on the asumption that the telemotor steering gear was out of order and on the theory that having regard to the fulness of the stern of the Empress, the area of the rudder was insufficient.

It may be remarked that this was not pleaded by the defendant, and, in my opinion, the evidence shows clearly that the steering gear was in good order and there is not a shadow of evidence to show that there was anything wrong with it at the time of the collision, or that it, in any way, contributed to the said accident.

In addition to the evidence taken before the commission at Quebec, which will hereafter be referred to by the number of the questions applicable to the different matters at issue in this cause, the Liverpool pilot, who was examined for the first time before this court, testified that he had been pilot in charge of the Empress of Ireland, while she was proceeding to sea ever since the ship was launched, sometime in the year 1906, and he spoke in highest terms of her steering gear. I do not think this question requires a more detailed explanation.

Much comment has been made on the fact that Captain Kendall says, just before the ship sank he looked at the compass and found her head S.E. The present position of the wreck is with her head N.E. When we take into consideration the fact that there was no light for him to see the compass by, and take into consideration that he was steering eastward, it would be easy for him to confound S.E. with N.E. There is also another explanation. Nothing will cause deviation of the compass more than a heavy jar. The Empress had jar enough to send her to the bottom. Then the angle of the ship was 45 deg. or more, and no ship has her compasses adjusted for such a serious heeling error, so that this compass which he looked at might be altogether useless, and the S.E. that Captain Kendall imagined he saw might be several points out.

The evidence being so contradictory, the witnesses from the Storstad saying that they were approaching so as to pass red to red, while those of the Empress of Ireland say they were approaching so as to pass green to green, the stories are irreconcilable, and we have to determine which is the more probable.

Position of the Ships.

In order to place the responsibility for the disaster, the first point I will dispose of is the position of the Empress at the time of the collision, say at 1.55 a.m. I think I am entitled to state positively that it was 1,200 to 1,500 feet to the eastward or past the place where the wreck now lies, and that is marked on the defendant's chart or diagram No. 3, produced by Mr. Griffin, one of the defendant's counsels, in illustration of his argument from the position ofthe churches, namely: It lies N. 62½ degrees W., 7 1-6 miles from Ste. Flavie Church; it lies N. 11 degrees E., 4 2-5 miles from St. Luce Church; it lies N. 45 degrees E., 6¾ miles from Father Point light house. The position of the wreck has been checked by me, with the assistance of the assessor, and it agrees with the above bearings.

I know the position of the wreck and I know by many witnesses that there was a current of one mile an hour running westerly, and it is well-known that the Empress sank fifteen minutes after the collision. She drifted back with the current fifteen minutes after she was struck. This places her position exactly at the time of the collision 1,200 or 1,500 feet to the eastward, or past the wreck, provided she was lying dead in the water, as she claims to be at the time of the impact.

Empress Control.

We have the evidence of Captain Kendall (Q. 20), Captain Murray (Q. 4079), Brennan (Q. 138), Murphy (Q. 2177 to 2194) that she could be stopped dead in the water from two to three minutes, and cases have been cited where it has been done, such as off Point Lynas, off the Welsh Coast, in two minutes and fifteen seconds (Q. 4199).

On the present occasion, we have the evidence of Captain Kendall (page 26), Brennan, that on seeing the Storstad's light being shut out by the fog, they reversed their engines for three minutes, blowing, while doing so, two whistles of three short blasts, to let the Storstad know that she was reversing. Then, according to the evidence, she blew two whistles of two long blasts, indicating that she was stopped in the water, which is verified by Jones, the first officer (Q. 1764), Captain Kendall (Q. 218), John Murphy (Q. 2194), Brennan (Q. 2149), Liddell (Q. 2540), and Miss Townsend (Q. 7205). Tuftenes and Saxe heard the three short blasts twice (QQ. 1092, 1094), which is important and material evidence, as Tuftenes admits he heard the Empress's three short blasts about one or two minutes apart. Therefore, he admits she was reversing for that time, sufficient to bring her to a standstill. Saxe (Q. 4650) also admits the same, though the Storstad denies at all times hearing the Empress's two whistles of two long blasts saying she was stopped.

After carefully considering all the evidence, I have come to the conclusion that the Empress was stopped. I think it has been established that the Empress's position, at the time of the collision, was 1,200 to 1,500 feet eastward from the wreck, notwithstanding the contradictory evidence that has been produced. The fact remains that she was dead in the water fifteen minutes before she sank, and she had to be from 1,200 to 1,500 feet past the position where the wreck now lies, notwithstanding all arguments to the contrary.

Leading to the Collision.

Having established the position of the Empress dead in the water at the time of the collision, I will review the action of the vessel which led to the collision. I will first speak of the courses of the two ships, which I consider as most important. The evidence is emphatic that the Empress was steering a final course of N. 73 deg. E. and never varied this course. I am forced to accept it, and the assessor concurs, and the same applies to the Storstad's course of W. by S.

Now, it is shown by the chart or diagram prepared at my request by the assessor, verified by me, and signed by me and the assessor for identification, that these two courses were converging and that two ships approaching each other in opposite directions, on these courses would meet or cross each other at a given point. This crossing point must be the position of the Empress after she was stopped in the water at the time of the collision.

It having been proved that the Empress was stopped in the water, and that her position was from 1,200 to 1,500 feet to

the eastward of the wreck, by looking at the chart, it will be seen that during the whole time the Empress was following her N. 73 deg. E. course. She had the Storstad on her starboard bow and this disposes finally of the contentions of the Storstad that she saw the Empress's red light. At a distance of a mile and a half or two miles apart where both parties agree they last saw each other before the collision and when their lights were commencing to be dimmed by the fog, the Empress would be showing the Storstad her green light, and the Storstad would be showing the Empress her red light, unless the Storstad was to the southward, as I think she was, then she would be showing her green light. This can be verified by looking at the chart. I think it is quite probable that at this time the colored lights of both ships were obscured by fog, but if they saw any colored lights at this time, they would have to be as stated by me.

Now, I will take up the question of the action of the two ships when they both arrived at the position of one mile and a half to two miles apart, after which they were obscured by the fog until the time of the collision, which is proved to be about eight minutes. They enter this area of one mile and a half to two miles going at full speed, say sixteen miles per hour for the Empress, and eleven miles per hour for the Storstad. Therefore, they were approaching each other at the rate of twenty-seven miles an hour. At this rate of speed, they would have either collided or passed clear in three or four minutes. Considering the close proximity of the vessels at this time, any change of course might have been imprudent, particularly as they were running into a fog bank and this explains the fact at this point, say at 1.47 a.m. the Empress order her engines full speed astern, and notified the Storstad by the appropriate whistle of three short blasts that she had done so.

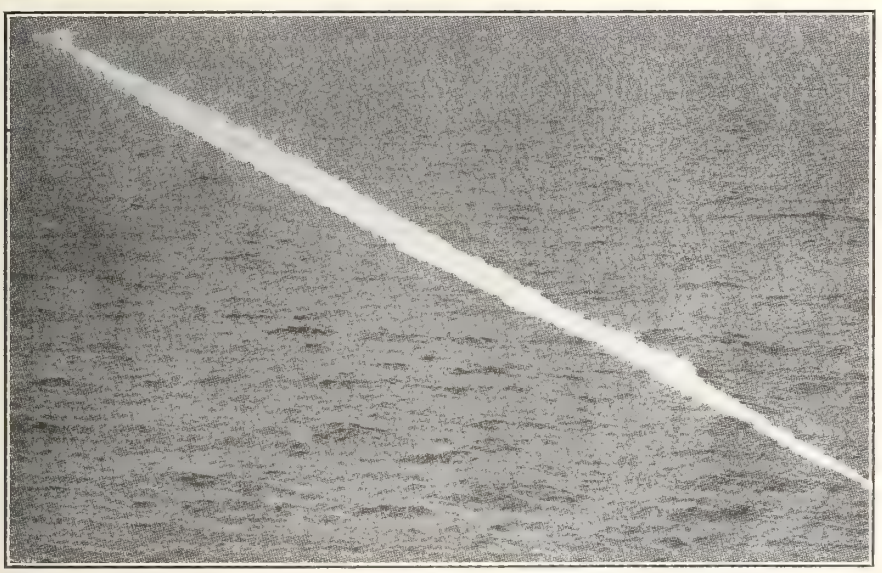
Instead of following the example of the Empress and reversing her engines, the Storstad merely slowed her engines and continued her speed; about eight minutes after the Empress started to reverse her engines, the collision occurred, say at 1.55 a.m.

Any difference of opinion as to the time here seems to be absolutely of no importance as we have the evidence of the Empress that she was reversing for three minutes and the evidence of the Storstad that she knew the Empress was reversing, having heard her signal of three short blasts. Now, what happens in this interval of eight minutes before the collision occurred?

The Empress goes about a quarter of a mile or practically three ship lengths under reversed engines, before she is brought to a standstill. The evidence shows that this took three minutes. During these three minutes, the Storstad is going on with no effort to check her speed other than slowing her engines, and must be going at a speed of say eight knots, which is a compromise between full speed, eleven knots, and slow speed, five knots. She would cover the distance of nearly half a mile.

This leaves the ships about three-quarters of a mile apart, and five minutes yet to go before the collision occurred; the Empress is dead in the water and the Storstad is continuing on her course. At some part of this period, she claims she came to a dead stop, then ported her helm, only affecting her heading a quarter or half a point, and ordered slow speed ahead again.

VIEW OF SUBMARINE FULLY SUBMERGED, RUNNING AT 10 KNOTS AND SHOWING TWO PERISCOPES.—Cut, Courtesy of "Syren and Shipping."



WAKE OF A TORPEDO FIRED FROM A SUBMERGED SUBMARINE.
Cut, Courtesy of "Syren and Shipping."

Storstad Speed.

I will make some observations as to the probable speed of the Storstad at the time of the collision. At a mile and a half apart, the Storstad was going eleven knots an hour with the current. She then slowed her engines. At the time of the order to slow down, she was still going eleven knots. It would take some time for her to come back from her eleven-knot speed to slow speed, which is about five knots an hour. Therefore, when the next order to slow the engines was given, two minutes later, by the evidence, it was reasonable to suppose that she was going at eight knots per hour. As it would take her some time to come to a standstill from a speed of eight knots an hour without reversing her engines, and taking into consideration how close she was to the Empress after these first orders were given, I cannot see how she can have lost her way, particularly as she again started slow speed ahead before the collision, and after her order to stop.

Her next order was full speed astern and that was only thirty seconds before the collision. She therefore seems to have maintained her speed all through the short period before the collision and it is my opinion that at the time of the impact, she was going at not less than six knots an hour, and probably more. The depth she penetrated into the Empress's side, which the evidence gives all the way from ten to eighteen feet, and

the condition of her own bows after colliding would go to substantiate this speed. I would mention that the Storstad is built longitudinally, or on the Isherwood system, and consequently very strong, and the damage to her bows was very extensive.

Facts Established.

In my opinion, three facts have been established:

The position of the Empress when she was stopped in the water, fifteen minutes before she sank;

The fact that the Empress was stopped in the water; and the fact that, at the time of the impact, the Storstad was travelling at least at a rate of six knots an hour, or probably more.

In arriving at my finding as to the responsibility for the collision, other considerations come in which I will enumerate later, but I would like to mention that I consider the evidence on both sides, other than that above referred to, immaterial and of little value.

For instance, the defendants, on their chart and in the calculations of course and distance, etc., have gone on the assumption that the current was against them at the rate of a mile and a half per hour, while it was in their favor one mile per hour, so that on their own contentions, with their own chart, they would be in a position past the wreck before they ever started the manoeuvres that occurred just previous to the collision.

They base their contention that the Empress could not cover the distance to the wreck and remain dead in the water for some time before the collision on the theory that when the Empress started from a point one mile N. 43 deg. W. from Father Point buoy, she had stopped to let her pilot off, but it appears that her engines had never been stopped but were only slowed down, as is the usual practice, as I am advised by the assessor, and, therefore, she did not lose any time in the warming-up process of her engines, which would have happened had they been stopped, but was able to increase her speed rapidly.

The colored lights were as I have represented them. If you will follow out the courses of the ships to the time of impact, on the chart hereto annexed and above referred to, you will see that the lights would appear as I have stated.

I am confirmed in my opinion that these vessels approached each other on their converging courses more rapidly than they realized, and as the Empress had the Storstad on her starboard bow, she adhered to the green light story, and as at the same time the Storstad had the Empress on her port bow, she adhered to the red light story, in order to evade responsibility for the collision.

Rules of Road Governing.

Articles 23 of the Rules of the Road says: "Every steam vessel which is directed by these rules to keep out of the way of another vessel shall, on approaching her, if necessary, slacken her speed, or stop or reverse." The Empress obeyed this rule.

Article 16:—"A steam vessel hearing apparently forward of her beam, the fog signal of a vessel, the position of which is not ascertained, shall, so far as the circumstances of the case admit, stop her engines, and then navigate with caution, until danger of collision is over."

Article 21:—"When, in consequence of thick weather, or other causes, such vessel finds herself so close that collision cannot be avoided by the action of the giving-way vessel alone, she shall take such action as will best aid to avert the collision."

Article 29:—"Nothing in these rules shall exonerate any vessel of the neglect of any precaution which may be required by the ordinary practice of seaman or by the special circumstances of the case."

Attention might be called to the way the Empress of Ireland was navigated. She had three first class officers on the bridge, namely, Captain Kendall, Mr. Jones, first officer, and Mr. Moore, third officer.

On the Storstad, Mr. Tuftenes, first officer, was in charge, perhaps assisted by Mr. Saxe, third officer, though the latter claims he had nothing to do with the navigation of the ship.

In my opinion, Mr. Tuftenes, in not stopping the Storstad, when he heard the first three blasts from the Empress, made a great error of judgment and to my mind, had Captain Anderson, the master of the Storstad, been called earlier and had been on deck, he would immediately have stopped his ship and avoided the whole calamity. I cannot emphasize this neglect too strongly.

Placing the Blame.

I regret very much to have to find Mr. Tuftenes at fault in violating Articles 16, 21 and 29 of the rules of the road above quoted. Through his neglect or inexperience, in my opinion, the cause of the accident was the speed of the Storstad, and the porting and hard-a-porting of her helm. The Storstad is entirely to blame for the said accident, because Mr. Tuftenes had the opportunity to take the speed off his ship, the same as the Empress did, and if he had not ported her helm, I believe he would have gone clear and the collision would not have occurred.

I regret very much to have to impute blame to anyone in connection with this lamentable disaster, and I would not have done so, and would not do so, if I had felt that any reasonable alternative was left to me. There is nothing to show that the disaster was in any way attributable to the St. Lawrence route, and being open water, all sea rules apply.

In conclusion, I am of opinion that Mr. Tuftenes, the first officer of the Storstad, was wrong and negligent in altering the course of the Storstad in the fog, as he undoubtedly did, and that he was also wrong and negligent in keeping the navigation of the vessel in his own hands and in failing to call the captain when he saw the fog coming on.

I am further of opinion that no fault or blame is attached or attributed to the Empress of Ireland, and, consequently, I am of opinion that plaintiff's action must be maintained, with costs, and the counter claim of the defendant rejected, and the defendant is condemned by the present judgment to pay to the plaintiff the sum to be found due to said plaintiff, and in costs and the present judgment doth further order that an account shall be taken and doth refer the same to the Deputy-Registrar, assisted by merchants, to report the amount due the plaintiff in respect of its claim, and that all accounts and vouchers, with the proof in support thereof, shall be filed within six months from the date of the present judgment.

CANADIAN CANAL TRAFFIC IN 1914.

THE statistics compiled by J. L. Payne, comptroller of statistics for the Department of Railways and Canals, Ottawa, place the volume of traffic through all the canals of Canada during 1914 at 37,023,237 tons, as against 52,053,913 tons in 1913—a decrease of 15,030,676 tons. The distribution of traffic, together with decreases and increase, was as follows:—

Canal.	Tons.	Inc.	Dec.
Sault Ste. Marie..	27,549,184	.....	15,100,140
Welland	3,860,969	290,255	.....
St. Lawrence	4,391,493	89,066	.....
Chambly	436,905	.....	118,697
St. Peters	54,180	.....	17,334
Murray	83,907	.....	96,669
Ottawa	335,132	.....	30,306
Rideau	151,739	.....	19,484
Trent	67,715	11,915	.....
St Andrews	42,013	.....	.....
Total	37,023,237	391,236	15,421,912

It will be observed that the unprecedented falling-off in traffic during the year 1914 occurred almost wholly at Sault Ste. Marie. Of the total decrease of 15,030,676 tons, 1,748,669 was in Canadian and 13,282,007 in American waterborne commerce. The decline in American traffic was very largely in the movement of iron ore from the head of Lake Superior to ports on Lake Erie.

The gross traffic through the canals since 1905 has been as follows:—

Year.	Tons.	Year.	Tons.
1905.....	9,371,744	1910.....	42,990,608
1906.....	10,523,185	1911.....	38,030,353
1907.....	20,543,639	1912.....	47,587,245
1908.....	17,502,820	1913.....	52,053,913
1909.....	33,720,748	1914.....	37,023,237

Scotia II., Canadian Government Railway Ferry, Launched

The launch of this vessel and the happy, thoughtful and highly appropriate speech of Lady Drummond gave opportunity and expression respectively for our people at the "Heart of Empire" to learn still more of the sincerity and enthusiasm with which their overseas kindred are bearing and playing their part in this day of Imperial stress and in the combatting successfully of a projected world tyranny on the part of a wily and resourceful enemy.

BEFORE a small company of ladies and gentlemen at the Walker shipyard of Sir W. G. Armstrong, Whitworth & Co., Ltd., the Canadian Government Railway ferry steamer Scotia II was successfully launched on April 13. The christening ceremony was performed by Lady Drummond, of Montreal. Amongst those who accepted invitations to be present were Wm. Gray, Col. and Mrs. R. Saxton White, Edwin L. Orde, Major Lowe, the Lord and Lady Mayoress of Newcastle (Alderman and Miss Fitzgerald), the Sheriff of Newcastle (Dr. R. P. Dawson) and Mrs. Dawson, Mr. and Mrs. Douie, Dr. and Mrs. Appleby, Miss White, A. Laing, and Miss Laing, Mr. and Mrs. R. Trail, Mr. and Mrs. Oswald Tyrer, Mr. and Mrs. Harrison, Mrs. Stephenson, Mr. Ferguson, and Mrs. W. Lee.

Vessel Features.

The steamer has been designed and built by the purpose of carrying railway cars across the Strait of Canso from the mainland of Nova Scotia to Cape Breton Island on the Truro-Sydney line. Her principal dimensions are as follows:—Length overall, 300 ft.; length between perpendiculars, 282 ft.; breadth extreme over fenders, 50 ft.; depth, 20 ft. The draft of water, when laden with a total dead weight of 1,385 tons, is 14 ft.

The vessel design is of a quite unusual description. She is intended to carry on a railway service under all conditions, which entails her passing across the strait when it is more or less blocked with drift ice. The scantlings therefore, are arranged in accordance with ice-breaking practice, and the form of the ends has been arranged to comply with these conditions so far as is compatible with the full deck line required by the fact that there are three railway tracks to be accommodated on the deck, which makes the problem one of considerable interest.

Propelling Machinery.

The propelling machinery consists of two sets of triple-expansion engines, each actuating a propeller, one at the forward and the other at the after end of the vessel. The engines are so arranged that both propellers can be worked together, or separately, and either engine can be arranged to work both propellers. The machinery throughout is of a strength sufficient to resist the shocks encountered whilst working amongst ice, even though these be sufficiently severe to stop the propellers when working at full speed.

Accommodation is provided for two captains and two sets of officers, one for night, and the other for day service. The control for the navigation of the vessel is arranged in a pilot house on a specially high bridge, in which are fitted the usual steering gear and telegraphs, and a projector is arranged immediately overhead for working at night. The comfort of officers and crew is provided for so far as is possible in a vessel of these dimensions under the varying temperatures, and care has been exercised in all details to avoid any interference with the working under extreme winter conditions.

Launch Luncheon.

Colonel Saxton White presided over the luncheon which followed the launch. Proposing "Success to the Scotia II," coupled with the name of Lady Drummond, he stated that his audience would gather from the name of the vessel that she was preceeded by another vessel of the name of Scotia, which his firm built for the Canadian Government Railways in 1900. The new vessel was about 20 ft. longer than the old one. Colonel White proceeded to give the following particulars of the steamer, which are additional to those in the foregoing description.

The vessel's displacement, he said, would be 3,570 tons. Her engines would have cylinders of 21, 34 and 54 in., with a stroke of 30 in., and her indicated horse power would be about 3,000, developing a speed of 10.5 knots. There were three railway tracks on deck, which would accommodate 21 freight cars, or nine of the large Canadian passenger cars. The deck was made of sufficient strength to carry the heaviest known locomotives.

The machinery, which had been made by the Wallsend Slipway & Engineering Co., was rather unique. There was one engine with a shaft extending from the after end of the vessel—which was its usual position—to the forward end of the vessel, so that she has two propellers, one aft and one forward, driven off the same line of shaft.

The vessel was constructed for efficiently breaking ice. She had very strong cast steel rudder frame posts, and all her plating along the sides was of extra thickness, and very heavily-framed inside to withstand the pressure of the ice. Generally speaking, with the experience of the Scotia, built in 1900, all the improvements which could be suggested by the Canadian Government officials had, he thought, been carried out in the second vessel, and he thought they might confidently look forward to her maintaining the good service which had been rendered by the first Scotia in carrying on the train ferry of the Inter-Colonial Railway. He added that the vessel was fitted with an electrical installation, including a very large searchlight to be worked when passing through ice on winter nights. The toast was cordially honored.

Lady Drummond's Eloquent Reply.

Lady Drummond, responding, said that she thought this had been a great opportunity for her, one she had never had before. It was the first ship launch she had witnessed, and she had found it a very thrilling experience. To her, as to almost everyone, a boat had always something living about it. It was like a live thing, and, therefore, its first setting forth upon the waters had always something solemn as well as romantic, about it.

She could quite understand how, by the nautical men, a boat was always something of a personality, a feminine personality—as shown by the way in which a boat was spoken of. The fact that the boat was spoken of as "she" was, she took it, an implicit compliment to her sex. It rested largely with women and boats and trains to federate and unify the world. Addison used to say, "Women were made to be the cement of society, and came into the world to establish the relations among mankind." If they changed the word "women" to "boats" it was equally true.

Of course, it was often said that the ties which bound a nation or an empire were, or should be, essentially spiritual, or, as some would prefer to say, sentimental; but if we left these ties as pure spirit in a world conditioned by time and space, they would very soon vanish away.

It was really our boats and our trains and our great lines of intercommunication by land and by sea which gave effect to that spirit, and made it possible for our Empire to remain a great organic

community, "fitly joined together," in apostolic language, "and compacted by that which every joint supplieth," and greater in every part, as well as in the whole, because of its inter-dependence. So, she always thought that every part of our great Empire was very much greater for being a part of that Empire, and that every part shared the greatness of the whole, just as the whole was greater by every part.

Scotia II. was to play a very real and a very necessary part in the work of consolidation to which she referred. The vessel would go out to Canada to be one more link in the federation, the confederation of that great and varied country, and the speaker was pleased to have the opportunity of congratulating the great firm which had built her, and congratulating the Dominion Government, as well as the two provinces which the vessel was going to cement.

The speechmaking concluded by the presentation, by Colonel Saxton White, to Lady Drummond, of a silver cup, a copy of an old Northumbrian pattern, as a memento of the occasion.

We are indebted to the Liverpool Journal of Commerce for the foregoing data.

ST. LAWRENCE RIVER PILOTS.

IN accordance with the new by-laws of the pilotage district of Quebec, as published in a recent issue of the Canada Gazette, the superintendent, who has control over pilotage affairs in the district for the Minister of Marine and Fisheries, is required to issue an order payable by the shipping agent to the pilot in person for his services, after deducting the amount required for the Pilots' Pension Fund. The payment to the pilots personally is the principal change in the by-laws, as, before, the money went to the Corporation of Pilots, which distributed it among the members.

Apprentice Pilots.

Every apprentice pilot has to serve an apprenticeship of seven consecutive years, spending the seven winter seasons at sea or in the coasting trade of Canada. He has to make at least fifteen round trips between Quebec and Father Point in company with a branch pilot, and during his apprenticeship he must obtain a certificate of competency not lower than mate for steamships in the coasting trade.

In the Montreal district the by-laws are practically what they were last year. Every apprentice pilot has to serve an apprenticeship of five consecutive years, of which five seasons of navigation shall be spent on vessels trading between Montreal and Quebec on the River St. Lawrence.

Every regular line pilot will have under his charge on every trip between these points one of the apprentice pilots selected by the department, and each of the selected apprentice pilots (who will not exceed seven) have to make at least fifty trips each season with a branch pilot. The other apprentice pilots have each to make thirty trips with a pilot as employee on a vessel plying between these ports, or as pilot of vessels not subject to compulsory payment of pilotage.

Every apprentice pilot selected by the Minister has to make an ocean voyage before the mast to and from Europe during every winter season, or a coasting voyage south of Cape Hatteras. There have to be at least three voyages, each to be made in a separate winter.

SUPPLYING OIL TO SUBMARINES.

SOME interesting particulars were given in a recent number of the "Petroleum World" upon the methods adopted to supply oil to submarines when at sea, the location being kept secret between the crew and the supply ships.

The reservoir used is a steel cylinder, having compartments at each end into which air can be pumped to bring the vessel to the surface. The central part of the vessel, a cylinder of 150 feet long, having a capacity of 2,280 tons of oil, is divided into four compartments, in which the oil is carried. When on the bottom, the location of the vessel is indicated by a small buoy or other "mark" not noticeable except by those on the look-out for it. The submarine in need of fuel raises by means of the line attached to the buoy a flexible hose connecting with one of the air compartments, and pumps in air, which brings one end of the vessel to the surface. At this end is situated the valve house in which the connections for all the oil tanks are fitted, and it is an easy task to pump the required quantity of oil, sea water being pumped in, if necessary, to sink the vessel. The supply ship arrives on the scene when the submarine is far away and reverses the process, pumping oil in and forcing the sea water out.

German Bomb.—Professor Kling, director of the Paris Municipal Laboratory, has concluded a detailed examination of an unexploded bomb, weighing 89 kilos., dropped by a Zeppelin. The bomb, spherical in form, with a diam. of 35 cm., contained about 60 lb. of "T. N. T." and was operated by clockwork, set in motion at the moment of dropping the bomb and liberated at the right instant the striker intended to explode the capsule of fulminate of mercury, which would fire the charge.

IS TUG OWNER A COMMON CARRIER?

THEIR Lordships of the Court of Appeals are called upon to declare whether the proprietor of a tug who takes in tow a raft or cribs of saw logs is liable as a common carrier for any accident which may ensue whilst the logs are being towed. The appeal is that of Kearney vs. Dansereau, and the higher court will have to declare two rulings—one handed down by the judge in the court of first instance, declaring that the tug owner was a carrier by water and was liable as such; and the other, by the Court of Review, reversing the Superior Court's finding and declaring that the owner was not a carrier by water.

The case, which is a long-winded affair, may be boiled down, briefly, as follows, as far as the facts are concerned: Plaintiff-appellant (Kearney) alleges that in November, 1910, plaintiff entrusted certain rafts of logs to respondent (Dansereau) to be towed down from Grenville to the Lachine Canal, Dansereau having a tug for this very purpose. When nearing their destination, certain of the rafts separated and many logs were lost. The usual allegations of want of care, etc., are made, and it is demanded that compensation be required of respondent as a carrier by water. Respondent denied any negligence, and averred that if any mishap occurred it was through the fault of plaintiff's own employees, who were on the rafts and in charge of them.

The trial court held that the respondent was liable for the accident, as a common carrier, under article 1675 of the Civil Code and condemned him to pay plaintiff-appellant the value of the logs lost.

In the Court of Review it was held, on the contrary, that the liability of the respondent was not that of a common carrier, and that no fault or negligence having been established against him or those for whom he was responsible, the judgment of the trial court should be reversed and the incidental demand of the appellant dismissed. Hence the present appeal.

In the course of the argument appellant submitted that the trial judge had every opportunity of seeing as well as of hearing the witnesses and was justified in finding as he did—that this was an ordinary case of carrying for hire. Appellant further submitted that the evidence fully bore out the allegations of negligence and fault on the part of the tug owner and asks that the judgment in the court of first instance be restored.

About ½ per cent. of tungsten is generally used in the steel for gun shields in order to obtain hardness.

CANADA'S ATLANTIC SEABOARD

Shipping and Shipbuilding Enterprises and Industries are Again in the Ascendency in Our Maritime Provinces, and Revival of the Old-Time Activity Appears Imminent

I.C.R. DEEP WATER TERMINAL — HALIFAX, N.S.

THE new pier No. 2, of the Intercolonial Railway deep water terminal, at Halifax, N.S., is 686 ft. long, by 235 ft. wide. and is first of four piers proposed to replace much smaller ones. The work was started in the fall of 1911, and the pier and shed built thereon are now nearing completion.

WEST END WALL OF SHED.

NORTH SIDE OF PIER, LOOKING EAST.

Borings showed solid rock at a depth varying from 52 to 68 feet overlaid with from 2 to 12 feet of hard pan and from 5 to 27 feet of soft mud. This means an average height of 75 feet from rock to track level, which was fixed at 15 feet 8 inches above extreme low water. Reinforced concrete brace piles were used, driven at an angle of 3 in 1, and this is believed to be the first application of such a system of bracing to reinforced concrete work.

The Pile Feature.

Altogether, 1,550 concrete piles were driven into position, these being 24 inches square and 75 feet long. A special pile driver was constructed expressly for the work, and three separate cushions were used between the concrete of the pile and the ram of the hammer. On top of the pile, a 3-inch spruce plank was placed, on which rested a cast steel follower about four feet high, consisting of a hollow cylinder or post with top and bottom flange. On top of this again was placed a hardwood block, 15 inches thick and bound with a steel band. This block received the blows and had to be frequently renewed. On one occasion the block was found to be on fire and badly charred owing to the heat generated by the force of the blows. In many cases 1,880 blows were required.

Little damage was done to the piles in driving, only two out of 1,550 having their heads smashed. In order to test the bearing load of the piles after driving, a load of 120 tons was supported on the head of one pile and left there for three hours. No settlement resulted.

To resist the chemical action of the salt water, cement was used with a maximum of 6.3 per cent. of allumina. The water absorbed by the concrete at high tide freezes at low tide in the winter causing the surface to spall away between the tide levels, and to resist the frost action, the concrete within the ordinary tidal range is sheathed with timber treated with creosote and covered with pitch.

Building Features.

The building is a two-storey shed, 677 feet long, 198 feet 6 inches wide and 44 feet high from railway track level to the clerestorey roof. The columns, floors, roof and walls are of reinforced concrete, while the side doors to the upper and lower floors are of steel, glazed with wired glass. All window frames are of steel and the greater part of the glass used is wired. The building itself is fireproof. The temporary partitions which have been erected in the upper storey to form rooms and halls for the examination of immigrants, until such time as the proposed permanent building for that purpose at the south end terminals is constructed, are of wood. The upper floor will be devoted to passengers and baggage, the lower floor to cargo and mail.

The lower freight floors, one on each

SOUTH SIDE OF PIER, LOOKING EAST, ON JANUARY 4, 1915.

side of the central railway track are each 87 feet 3 inches wide by 677 feet long with a height of 18 feet 6 inches from floor to ceiling. The upper floor has a clear width of 197 feet 4 inches and length of 677 feet. The average height of the ceiling is 14 feet 8 inches, except under the central clerestorey where the height is 19 feet 8 inches. The manner of construction of the building is as follows:

After the construction of the concrete pier dock was sufficiently advanced, timber forms or moulds were erected for the columns, girders, beams and floor slabs forming the upper storey floor. As the forms were completed, the reinforced steel was put in place and the concrete poured in. When the concrete had attained sufficient strength to carry its own weight and that of the roof, the temporary timber forms were removed to be re-used in another section of the building. The construction of the roof followed that of the upper floor in the same manner.

The pier and its shed have been designed for the use of freight steamers for whose cargoes there is ample accommodation in the shed. The strength of the structure is such that there can be little or no danger of overloading the floors. The wide spacing of the columns and the hard surface of the floors facilitate the rapid handling and moving of gangways and freight. The cost of the pier will be approximately $690,000, while the cost of the building will be approximately $330,000, not including the cost of the fitting of the temporary and permanent offices and rooms, which will cost an additional $105,000.

The entire work is being done by the Nova Scotia Construction Co., of Sydney, Cape Breton, under the management of Hamilton Lindsay, vice president. John Kennedy, consulting engineer of Montreal, is the designer and chief engineer, and is represented on the work by A. F. Dyer, as resident engineer.

GERMAN SUBMARINES

AT a recent meeting of the French Society of Civil Engineers, M. Laubeuf gave the following data on German submarines:—

Information from the British Admiralty states that, at the commencement of 1914, Germany had 24 submarines ready and 14 in construction; of these latter, eight were completed when war was declared, the six others—U 33 to U 38—commenced in 1913, were certainly not finished when hostilities opened. On the other hand, Germany added to her own number of submarines five Austrian and one Norwegian boats, which were at the time almost completed at the Krupp Germania Yard, Kiel. The German Navy, therefore, had in all 38 submarines—U 1—was launched at the Germania Yard on August 30, 1905; being largely an imitation of the French boats of the Aigrette type, commenced in 1902. The accompanying table gives some particulars of the German boats.

Notwithstanding the great activity displayed by Germany in submarine construction since 1907, and the importance of the sums voted for this work, she has not had time to build a very large number. Her programme was to form, by 1917, a flotilla of 72 boats, and by the opening of hostilities she was able to put in service slightly more than half that number. Austria commenced the construction of submarines in 1907. When war was declared she had six ready, U 1 to U 6, of 300 tons, and four, on the Krupp designs, under construction at Pola. The five built by Krupp, above referred to, were to be numbered U 7 to U 11. The four Pola boats have been completed, and are numbered U 12 to U 16.

Table I—Dimensions of German Submarines

	U 1	U 2 to U 8	U 9 to U 12	U 13 to U 20	U 21 to U 32	U 33 to U 38
Date of commencement.	1903	1906-1907	1906	1909-1910	1911-1912	1913
Displacement on the surface	185 tons	237 tons	Slightly larger than the U 2 boats	450 tons	650 tons	675 tons
Displacement when submerged	240 tons	300 tons		550 tons	800 tons	835 tons
Length	128ft. 3in.	141ft. 8in.		....	213ft. 3in.	....
Breadth	11ft. 10in.	12ft. 4in.		....	20ft.	....
Draft	9ft. 2in.	9ft. 8in.		....	11ft. 10in.	....
Power of oil fuel surface, engines	400 e.h.p.	600 e.h.p.		1,200 e.h.p.	1,800 e.h.p.	2,500 e.h.p.
Power of electric underwater motors	240 e.h.p	320 e.h.p.		600 e.h.p.	800 e.h.p.	....
Maximum speed on surface	11 knots	12 knots		15 knots	16 knots	17 knots
Maximum speed submerged	8 knots	8.5 knots		9 knots	10 knots	....
Radius of action on surface	....	1,200 miles at 9 knots		....	1,500 miles at 12 knots	....
Radius of action submerged	....	50 miles at 9 knots		....	70 miles at 6 knots	....
Armament	One torpedo tube Three 17.7in. torpedoes	Two tubes Four 17.7in. torpedoes	Two tubes Four 17.7in. torpedoes	Two or Four tubes three tubes Four or six torpedoes One 1.456in. guns	Eight 19.6in. torpedoes Two 3.464in. guns	....

Vessel Particulars.

As regards some of the later boats, particulars were given in the "Navy Annual" as follows:—Length 214,1¾ ft., beam 20 ft., displacement 56 per cent., speed on surface 20 knots, horsepower of oil-motors 4,000 brake horsepower working on twin screws. It is thought that the five Austrian boats which Germany has kept have the same dimensions as the U 33 to U 38 boats. The Norwegian boat may be considered a replica of the U 9 type. It is stated that Germany put in hand 20 new submarines at the end of 1914.

In the summer of 1907, Germany had only one submarine in the service and seven in course of construction. The sum set apart for submarine construction in the 1907 budget amounted to £250,000. It increased rapidly, amounting to £350,000 in the budget for 1908; to £500,000 in that for 1909; to £750,000 in each of those for 1910, 1911, and 1912; to £1,000,000 in that for 1913; and to £950,000 in that for 1914.

Late in the Field.

Germany undertook late in the day the construction of submarines, since her first boat, the U 1, launched in August, 1905, only entered the service in February, 1907. By this means the German Navy was able to benefit by the experience gained elsewhere. Her first 12 boats resembled the French type Aigrette; the eight following boats, of a larger type, resembled the larger Pluviose class. M. Laubeuf adds that, for equal displacement and age, the French submarines have better nautical qualities and a more powerful armament than the German ones.

SCARCITY OF TONNAGE

THE scarcity of ocean tonnage continues to constitute the chief obstacle to the carrying on of the external commerce of the Dominion. An official statement has been prepared at Ottawa, showing to what extent the tonnage has declined chiefly as a result of the withdrawal of so many ships for Admiralty purposes, as well as from other causes arising from the war. The statement deals with the condition on both oceans and applies to all the principal ocean ports of the Dominion. The figures are for April, and in each case, the registered tonnage is given.

For Victoria, B.C. the figures are 152,373, as compared with 196,987; Vancouver, 140,600, against 212,920; Montreal, 2,734, against 35,958; Quebec, nil, against 40,232; St. John, 131,853, against 108,983, and Halifax, 125,000, against 223,052.

It will be seen that in every port with the single exception of St. John there is a substantial decrease in the tonnage for the month of April. The St. Lawrence figures are partly governed by navigation conditions.

TOWARDS the middle of last year, Canada, in common with the United States, and, to a certain extent, other countries, was experiencing the reaction due to a long period of prosperity, with its consequent extravagances and more or less wild financial speculation. One after another, factories began to lay off men. Then in August, like the fates, came the European war to change a condition of tight money and business depression into one of apparent hopelessness.

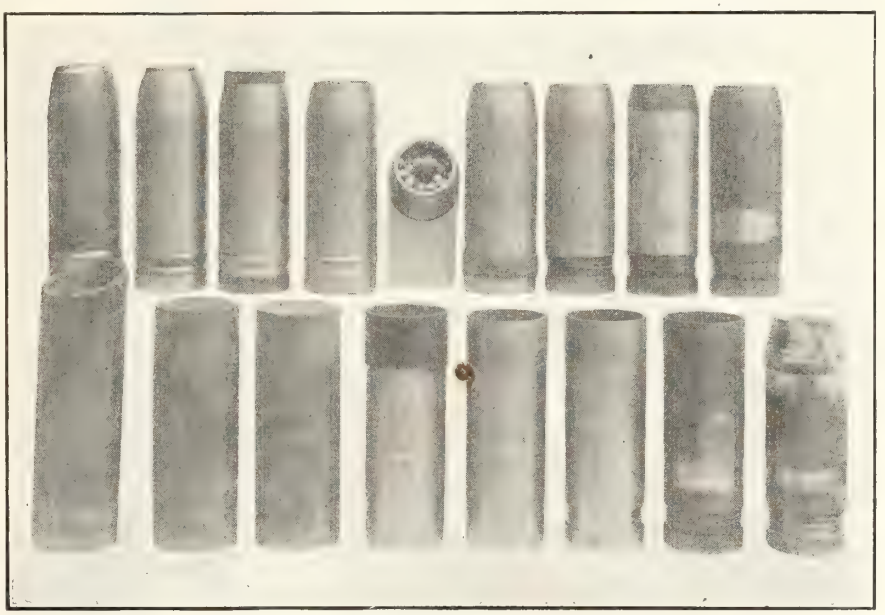
A more or less panicky situation developed, arising largely from the feeling of uncertainty as to our Empire's preparedness to protect its widespread territory, to maintain the freedom of the seas, to stem the progress of Germany's military machine, and help put a crimp in her long-time-cherished, all-conquering, but otherwise insane ambitions.

It was early noted, however, that, whatever the position from the land or strictly military viewpoint, with regard to sea power and sea control, "Britain ruled the Waves," and that although some little time must elapse before the various enemy raiders known to be afloat were driven to neutral ports or "Davy Jones Locker," trade and commerce would suffer otherwise little interruption. Intimation that the rush on Paris by the Huns had been permanently stemmed soon followed and served as it were to complete the assurance that the crisis had passed and that for industrial Canada the future motto would be that of capturing the enemy's trade. Broadcast publicity in the latter direction followed, but whether "what is everybody's business is nobody's business," or otherwise, results were nil, or at best disappointing.

Capturing Enemy Trade.

In this respect Canada was no more guilty of what might be termed a sin of omission than the Old Land or than the United States, and this leads us to remark that, after all, the slogan "capture the enemy's trade," was to a large extent but an expression of our indignation at their procedure, and smacked of school boy action and retaliation. Superlative effort to capture at one swoop enemy trade abroad may be classed in the impossibility category so far as results are concerned, and business men began to realize this even before the warmth of their enthusiasm so kindled had wholly cooled. They realized that doors of opportunity were open which hitherto had not appealed to them with the like insistence and forcefulness but they further appreciated the fact that the work must needs be one of more or less nursed development. To this end our manufacturers are now applying themselves, and the achievement recorded in the brief space of a few months is satisfactory evidence that if enemy trade is not being captured, it is at least being systematically acquired.

Reference has already been made to our Empire preparedness for war and more particularly war on the gigantic scale on which that now raging is being waged. Our fleet, the men who designed, built, manned, operated and directed it, had been, were and are easily equal to every contingency, humanly speaking, likely to arise. In matters military the position was and has always been different. The maintenance of a standing army running into millions of men of all ranks and services had neither been found desirable nor necessary. In like manner, war munitions were not on tap on a stupendous scale. To meet the unique military situation created by an all-European war the call was made for both men and munitions in number and quantity easily and altogether unprecedented in our Empire history. The munitions of war being the feature with which we are at present dealing more particularly, it is sufficient to remark here that as regards the call for men, the British Isles have done themselves proudly, and, we in Canada, have not only made noble response, but as recent



SHELLS IN PROCESS FROM THE FORGING TO THE PRODUCT AS COMPLETED IN CANADA.

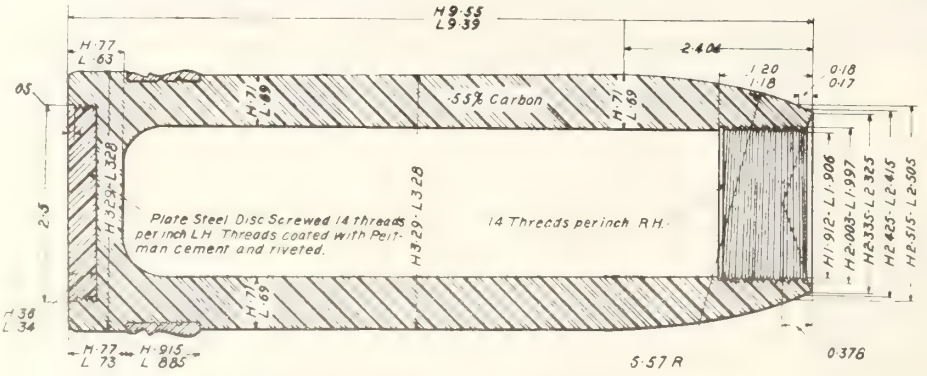
reports from the front only too plainly indicate, we, through our representatives there, are earning undying fame, the admiration of our friends, and have instilled into the hearts of our enemies the knowledge that we both know and are attending to our business, of whatever its nature may be at any moment.

Canada's Response.

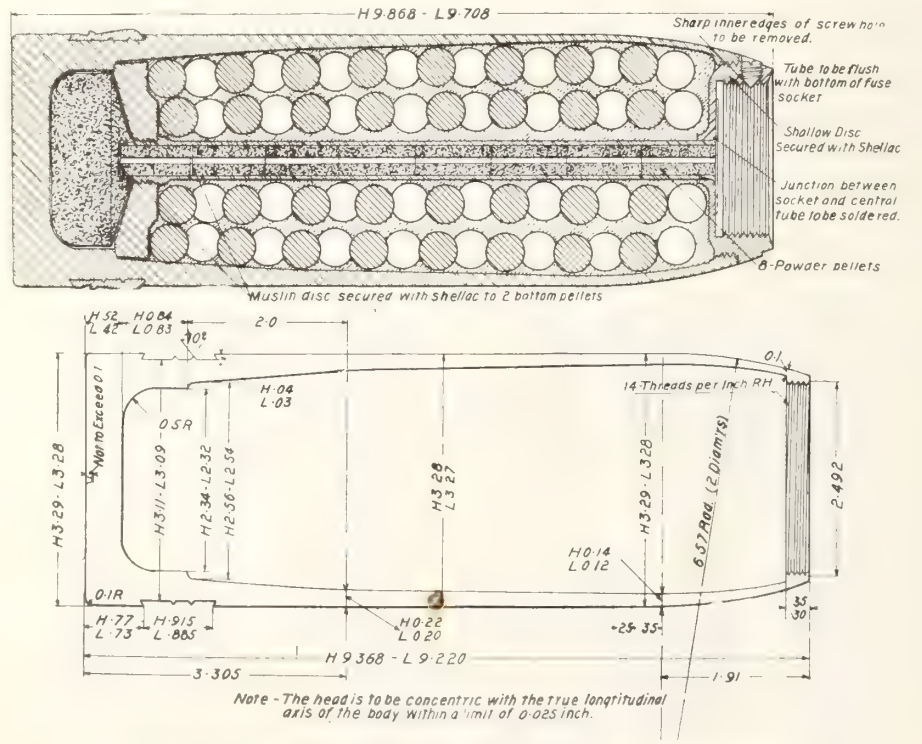
Little did Sir John French realize, when he gave utterance to the for-all-time memorable statement-request, for "shells, and shells, then more shells," in order to prosecute the war to its early and logical end, that Canada would play so important a part in placing these commodities at his disposal.

That our metal working industries have risen to the occasion is amply borne out by the peace-time variety-product plants we possess, having now become war-time producers of shrapnel and high explosive shells. More or less surprise is, however, being expressed—we should say simulated, rather — that "Canada's Response" has been so universally effective, and not a little credit is being appropriated by our American brethren for the achievement. It is claimed that for the most part we have in the past been devoid of enterprise, and that our manufacturers doted and were prone to converse on sport and recreation in business hours to an extent highly detrimental to the pursuit of commercial ascendancy. In a word, we are reputed to have been conservative, contented and easy going, and the fact that we have broken away from such a condition is being attributed to our sudden acquirement of the business energy of our American cousins.

Business and pleasure mate desirably, and either alone becomes nauseating if practised without intermission. Our manufacturers have realized that, for a period, whole-hearted devotion is meantime necessary to the equipment of their plants and to the establishment of ways and means for smooth running to secure quality and quantity output of shells. They have at the moment no time, it is true, to tell of fishing successes or of the exploits of hunting expeditions, but long before the war is over they will catch many fish, kill many deer, resume their wonted attitude of good fellowship in talking sport and pleasure and withal be supplying the Allies from twenty-four-hour-day capacity plants, with shells in number far exceeding present efforts.



BRITISH 18-POUNDER HIGH EXPLOSIVE SHELL.


H 9·868 - L 9·708
Sharp inner edges of screw horn to be removed.
Tube to be flush with bottom of fuse socket
Shallow Disc Secured with Shellac
Junction between Socket and central tube to be soldered.
8-Powder pellets
Muslin disc secured with shellac to 2 bottom pellets
14 Threads per inch RH
6·57 Rad (2 Diam's)
H 9·368 - L 9·220
3·305
Note - The head is to be concentric with the true longitudinal axis of the body within a limit of 0·025 inch.

CONSTRUCTIONAL FEATURES AND DIMENSIONS OF BRITISH 18-POUNDER SHRAPNEL SHELL.

Of all the crafts represented in the prosecution of the war, that of engineering in its every aspect is dominant, and it is therefore only fair and giving "honor to whom honor is due," to give our metal working plant administrations the fullest degree credit for the native initiative and enterprise which has characterized them at this critical period of our national and Empire history.

SCOTTISH SHIPBUILDING.

THE Scottish shipbuilding returns for April show that the industry—on the Clyde particularly—is coming to be almost naval, and that mercantile work is now taking a very secondary place. Up till the end of March, the output of merchant work was well maintained, and the total for the quarter was actually larger than for the corresponding three months of 1914. Now, however, war conditions are prevailing more, and as merchant vessels are being completed their places are being taken much more frequently by naval than by new mercantile work. Besides, the majority of the vessels booked previous to the war have now been launched, and none of those ordered in the slight boom of the autumn have yet reached the launching stage, so that a falling off about this time was inevitable. The figures show that naval work now accounts for by far the largest proportion of the activities of the yards and engine shops, and that the effect of the war is to reduce merchant shipbuilding to the lowest possible minimum.

The East Coast of Scotland has not been affected so much by war conditions as the Clyde, and almost the normal amount of work is still being done in the yards. The Clyde output of 7,480 tons makes a total for the four months of 32 vessels.

Dominion Wreck Commission Investigations

Following the proceedings of a vessel stranding or collision inquiry is fascinating alike to the mariner and landsman. Much food for thought is always available, and in not a few instances it seems well nigh impossible to reconcile our conception of disaster prevention achievement when confronted with a detailed recital of the circumstances which contribute to many marine tragedies.

S.S. "GLENMOUNT."

AT the formal investigation held at Kingston, Ont., on May 7, into the causes which led to the S.S. Glenmount touching ground on or near Gull Island Shoal, River St. Lawrence, on April 30, 1915, whilst in charge of an unlicensed pilot, Frank Patenaude by name, Captain L. A. Demers, Dominion Wreck Commissioner, presided, and was assisted by Captain Thomas O'Conner and Captain James Murray, both of Kingston, acting as nautical assessors. Francis King, appeared on behalf of the owners, The Montreal Transportation Co., and also of the master, Henry Peters.

Master's Evidence.

The master deposed that the S. S. Glenmount was a steel single screw vessel of 1,957 gross and 1,246 registered tonnage, with triple expansion engines capable of making 10 knots per hour, carrying 19 of a crew, including 2 properly certificated mates and 3 properly certificated engineers, in addition to himself. On the date of the casualty she was bound down from Kingston with a cargo of grain, drawing five inches less than the ordinary canal draught of 14 feet. The weather prior to and at the time of the grounding was overcast and dark, with rain showers; but sufficiently clear to maintain full speed.

As it is the custom with the firms navigating vessels in those waters to place a pilot on board who assumes entire control, in order that the master may obtain sufficient rest before resuming his responsibilities when working his ship through the canals, he, following out the custom of years, was not on the bridge, but was standing by the door of his cabin, looking out, and owing to the fact that he was not conversant with the lights and buoys in that vicinity and with the idea prevailing in his mind that the pilot was in charge and in full control, he did not take notice of things around.

When the ship touched, he went on the bridge and noticed that her engines were stopped and she was turning under a port helm. No bearings of objects had been taken to ascertain the exact position where the casualty occurred, hence his uncertainty whether the ship struck on Gull Island Shoal itself or a little patch further east. However, the wells were sounded and the ship was found making water rapidly. She was then headed for Kingston, where she is now undergoing repairs. He practically stated that he would not care to interfere with the pilot unless he saw something radically wrong. The mate's and engineer's logs were next examined by the Court.

Pilot's Evidence.

The pilot, Frank Patenaude, holds a master's certificate; but no license as pilot, and he asserted that this was his first mishap during 30 years, and that he has been in command for many years. This was his first trip on the S.S. "Glenmount." He corroborated the evidence of the master as to climatic conditions, and stated that he was alone on the bridge at the time of the grounding, the second officer having left his post sometime prior to the casualty. He did not enquire as to the speed of the vessel.

When passing Chapman Shoal, the course was necessarily altered in order to get in a proper position to steer for Granite State Shoal Gas Buoy, and when he thought he had run long enough, he ported the helm, the ship striking at the same time. Thereupon the captain came on deck, and the vessel having been turned westwardly, the tanks were sounded and as she was found to be making considerable water, she proceeded to Kingston. He stated that he never steered by compass nor took any bearings, or timed his actions in relation to the speed of the ship.

Second Officer's Evidence.

The second officer, Lewis Dicks, being called, said that he possessed a mate's certificate for the coasting trade, and that he was on duty from 6 to 12, but prior to the accident he left the bridge to give orders to the man on the look out, and did not return to the bridge till after the tanks had been sounded. He avers that he did not take any notice of lights, being unfamiliar with the locality; but corroborated previous statements as regards weather conditions and speed of the ship. No other witnesses were called as the Court considered no matterial evidence would have been elicited.

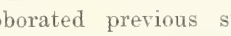
Finding.

The Court, after carefully reviewing the evidence adduced, finds that, in view of the existing custom, whereby the firm or owners of vessels plying between Kingston and Montreal, order that a pilot, having no license as such, be sent to join the ship at Kingston, to assume full control of the navigation of the vessel, virtually relieving the Master and Officers of responsibility, in order that the master may be enabled to rest prior to assuming command when working his ship through the locks, this custom having prevailed from time immemorial, according to statement made by counsel, and the masters of ships having surrendered the control of the navigation of their vessels almost entirely, no blame can be attached to the master, Henry Peters, who is hereby exonerated.

With regard to the second officer, his absence from the bridge, though it did not contribute to the grounding, is censured, especially in view of the information which the Court has received, that officers have orders not to leave the bridge.

With reference to the pilot, the Court places the onus of this casualty on his shoulders. Knowing under what conditions he was engaged, he should have taken every precaution, and unusual precautions in view of the condition of low water existing, a fact of which he was well aware. It is our opinion, however, that he has manifested an indifference by navigating only on assumption that the ship had about covered the distance. Though lights were observable ahead and astern, no use whatever was made of these aids to navigation. We assume that it is not always possible to take compass bearings, but in this instance had it been done, it is unlikely that this casualty would have happened. It is our opinion, therefore, that pilot, Frank Patenaude carelessly navigated the ship on this occasion. Having no license as pilot, and the Court having no power to impose a fine, he not being on the Articles as master or officer, and not being a licensed pilot, his certificate as master cannot be dealt with.

The mate's log having been examined and found to be absolutely useless to impart information, we would suggest that better supervision be exercised by the master with regard to the keeping of the log by the first mate, so that when it is required to substantiate statements which may be made, the desired correct information may be found therein.



Dardanelles Guns.—Those who landed after the first bombardments, to demolish the forts, found all sorts of guns, some old and some new, including fourteen 11 in. and 9.2 in. guns, besides howitzers and newly-made German aircraft guns, with a large quantity of ammunition, which was destroyed.

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OUR WAR ENGINEERING ACHIEVEMENT.

IN view of the widespread interest aroused in and attention being directed to the progress and development of the war, in whose prosecution we are participants to the extent of supplying both men and munitions, we have thought it advisable, because educative, to devote at least a small section of the present and immediately succeeding issues of our journal to featuring a few of the more outstanding methods and apparatus that are being practised and pressed into service to achieve success for our Empire and her Allies. As is now common knowledge, our engineering and metal-working plants, large and small, are loaded up to the capacity of their equipment, and, to some extent beyond same, with contents for shrapnel and high-explosive shells. The very creditable showing being made is a matter of supreme interest to all of our citizens.

"PRINCESS IRENE" DISASTER.

AS we go to press, official intimation is made that the comparatively new steamship Princess Irene, built with her sister ship, the Princess Margaret, at Dumbarton, Scotland, for the C.P.R. Pacific Coast service, has been literally blown to atoms and all on board with the exception of an injured stoker have gone to their death. A brief description of the construction, appointment and equipment features of the two vessels appeared in our August, 1914, issue.

It requires no stretch of imagination to infer that the destruction of this fine ship is the work of an enterprising enemy, through the medium and instrumentality of disguised individual or collective effort, and goes to show that no vigilance can be too incessantly active and no protective measures too strictly enforced.

THE CHALLENGE OF THE "LUSITANIA."

THE world's civilization rocks to-day. In various happenings of the last few weeks, arising, of course, out of the war, we have discovered that Germany's role as a civilized power was but a veneer and that things were not what they seemed relative to her heart and head. Whether the veneer has worn off, been rubbbd off, or has fallen off, is immaterial, she is little abashed about it, even although history—sacred and profane—marks no blacker page than the tragedy of the Lusitania in its challenge to High Heaven.

Widespread, and in large part, silent indignation has been aroused the world over; in some quarters revenge and swift retribution have been demanded, and by still others the incense to war is being pressed with a vigor quite worthy of the abnormal circumstances. Much impatience is naturally being exhibited, and as is usual, even under less trying circumstances, it is in no sense justifiable, because unnecessary. Germany in the past nine months has done more self-wrecking than the Allies with a triple backing could have even begun to accomplish and this feature need and should not be lost sight of under her most tantalizing dastardliness. The Lusitania will be avenged, and the direction and nature of the blow will neither emanate from Washington, London, Paris or Petrograd, although all or any of these may be the medium. The challenge to Christianity and humanity has been accepted, and will be met successfully.

As in the foundering of the Titanic, the tragedy of the Lusitania involved the engine and boiler room staffs, to the extent at least of those on watch below, and while more or less scant publicity has as yet been given or credit apportioned, we can believe that the best traditions of their craft and calling were maintained. An added inspiration has again been made available to those whose work lies in the below deck operation of our naval and mercantile marine, and the effect should be such as will lead to both greater personal fitness and a higher conception duty requirement.

MARINE NEWS FROM EVERY SOURCE

Toronto, Ont.—It is announced that the Toronto Harbor Commission will spend $2,000,000 this season on improvements. A large part of this money will be spent on the Ashbridge's Bay section.

The Coast and Lakes Contracting Corporation has been licensed at Toronto with a capital of $40,000 to construct wharves, piers, docks, etc., with head office at Toronto, Ont. A. J. Russell Snow, of Toronto, is attorney.

British Vessel Losses.—The cost of the war in British ships, not including warships, up to May 11, was 201 vessels, and the loss of life 1,556. The total of ships includes merchant ships, yachts, trawlers and drifters sunk from the opening of the war.

Ottawa, Ont.—Tenders will be received up to July 1, 1915, for the manufacture, supply and erection of a 30-ton steam wharf crane, of the derricking jib type, for Halifax, N.S., dockyard. The specifications and conditions of contract may be seen at the office of the consulting naval engineer, Ottawa.

C. G. Steamer Grenville.—Capt. Henry Esford, formerly of the steamer Kingston, has been appointed master of the new Government buoy steamer Grenville. The Department of Railways and Canals will operate the vessel, and she will be used exclusively for buoy service in the St. Lawrence River and the Upper Lakes.

Guarding Interned Vessels. — The North German Lloyd has requested the Hoboken police to supplement the large force of private watchmen who have been guarding the steamships and docks. The Hoboken authorities have detailed six policemen for this duty, and their salaries will be paid by the North German Lloyd. Indignation over the Lusitania outrage made this precaution necessary.

Rammed and Sunk.—The Canadian Government steamer Christine, while doing post duty at the naval station off Maheoux River, Island of Orleans, some 25 miles below the city of Quebec, was, on the evening on May 18, rammed and sunk by an unknown vessel. The Christine was 126 feet long, 20 feet beam, and had a draught of 9.6 feet. She belonged to John S. Thom, and was formerly a private yacht owned by Lord Strathcona. Her owner valued her at $30.000. Part only of her crew were saved.

Vancouver Lumber Shipments.—Thirteen vessels carrying lumber cargoes sailed last year from Vancouver, as against seventeen for 1913. Of the total shipments, aggregating over 26,000,000 feet, Australia took 6,159,748 feet; South Africa, 6,758,807 feet; Great Britain, 3,-931,243 feet; Fiji Islands, 859,364 feet; Japan, 955,600 feet, and the United States, 3,500,000 feet. The feature shipment of the year in timber products was 3,000,000 feet of cresoted railway ties to India.

Sault Ste. Marie, Ont.—Because of low water on the Great Lakes many vessels are forced to sail with 400 and 500 tons less than they would ordinarily carry if the water were normal. The recommended draught at the "Soo" for boats loading for Lake Michigan has been cut down six inches. All masters of the Pittsburg fleet have been notified not to load deeper than 19 feet 3 in. when taking cargoes from the head of the lakes for Lake Michigan. Many carriers trading to Lake Erie ports are now loading to 18 feet 9 in. only.

Lachine Canal Season.—The first accident of the season on the Lachine Canal occurred on the evening of May 3, when the steamer Rosemount, of Kingston, ran into the lock at Cote St. Paul, and broke both gates. The Rosemount was going up light, bound for Port Colborne, for grain. The smashing of the gates let a vast quantity of water down the canal, rushing the steamer down a considerable distance, while the volume of water was sufficient to flood over several of the locks below before it spent its force. Fortunately there was little other traffic in the canal at the time, so that not much further damage was done. A gang of men was at once sent to repair the broken lock.

Turret Chief Sold.—A deal has been closed whereby Adam Mackay of Hamilton, and asociates, have purchased from the Lake Hull Underwriters, the Canadian vessel Turret Chief, wrecked in the storm of November 9, 1913, on Lake Superior. The Turret Chief will be repaired, after which she will join the "back-to-the-coast" movement so prevalent among canal-size steamers of the lakes. The underwriters paid as a total loss on the steamer about $110,000. Mr. Mackay has chartered her for the first trip for a cargo of grain from the head of the lakes to Great Britain. The vessel will then ply exclusively in trans-Atlantic trade. The Turret Chief was built in England in 1896, and is 253 feet long and 44 feet beam.

Scarcity of Tonnage.—The opening of St. Lawrence navigation brings no promise of relief in regard to the scarcity of ocean tonnage. All the larger and faster ships formerly in the Canadian service are still in use by the Admiralty and there is no prospect of their being released, especially in view of the recent increase in the sphere of British military operations. The presence of large armies in Europe, in Egypt and in the Gallipoli Peninsula, calls for a large fleet of transport and supply ships, and there is no expectation that any of these ships will be released by the Admiralty during the present season. At the same time it is expected that a reasonably good mail service will be maintained, perhaps as good as the old service, though not equal to the improved fast and frequent service which was in operation prior to the outbreak of war.

Steam Barge Order.—In a welter of war orders large contracts based upon a peaceful expansion in domestic commerce are, unfortunately, rare enough to claim distinction at the moment. The Collingwood Shipbuilding Co., Collingwood, has received an order for a steam barge from the Imperial Oil Co. of Sarnia, and the announcement will be received with unusual satisfaction in Collingwood, especially as there is said to be a promise of a second contract later on. The Imperial Oil Co. has hitherto had its boats built on the Clyde, but in view of conditions existing there, it was decided to give local industries the preference. The barge will cost $200,000, and delivery will be made in

March next. The boat will be used largely on the St. Lawrence route, and if a second craft is ordered it will be placed upon the Pacific Coast.

Navigation Opening at Toronto.—The Dalhousie City, Captain J. W. Maddock, had again the honor of opening navigation at Toronto.

Storm Signal Service.—The storm signal service was resumed on all of the lakes on April 16, and will be continued until the close of navigation.

Low Water Level in St. Lawrence.—The extremely low water level in the St. Lawrence river is causing ship owners considerable worry these days. The level of Lake Ontario, according to the United States Lake Survey, is 0.23 foot lower than last month, and 1.71 lower than last year, and 1.44 below the average stage for April, of the last ten years, and only 0.20 above the very low stage of April, 1872, when the lowest record was reached.

Shipping Co. Registration. The Canadian Pacific Ocean Services, Ltd., has been registered at London with a nominal capital of £2,000,000 in £10 shares. The charter is a broad one covering the operation of all ocean traffic of the company with extensive and varied ramifications. The first directors are I. G. Ogden, Montreal, vice-president C.P.R.; G. M. Bosworth, Montreal, vice-president C. P. R.; E. W. Beatty, Montreal, vice-president C. P. R.; F. S. Meredith, K.C., Montreal; David McNicholl, Montreal; H. M. Kersey, manager-in-chief ocean services C. P. R., and Sir Thomas Skinner, Bart., Gresham House, E.C.

Detroit-Wallaceburg Service.—H. B. Smith, general manager of the Wallaceburg Steamship Co. has chartered the steamer Olcott, formerly the steamer Lakeside, of Sandusky, O., and will operate her on the Detroit-Wallaceburg route seven days a week during the summer season, beginning June 20. The Olcott is a craft capable of carrying 1,000 persons, and has a speed of 15 miles an hour. She is 160 feet over all, has a 30-foot beam and is of 337 tons burden. She has been fitted out especially for the run and her appointments are complete. Large deck space as well as an exceptionally commodious cabin has been provided, the latter being furnished with wicker chairs. Capt. Jay C. Fox, of Put-in-Bay, a cousin of Capt. A. J. Fox, of the steamer Put-in-Bay, will have command of the Olcott, and L. F. Miller will be chief engineer. The steamer will operate until Sept. 10. She will touch at Windsor and Walkerville, both going and returning.

From Lakes to Ocean.—There are indications that the coastwise traffic of the United States will be increased by the tranfer of ships that have been used on the Great Lakes. This will result from the order of the Interstate Commerce Commission, compelling the railroads to dispose of their ships used in the Great Lakes by December. It was reported that the Rutland Railroad has sold two of its lake steamers for use in the Atlantic and many other railroads will be forced to sell their ships to firms engaged in ocean service in order to obtain fair prices for them. Shipping men say that many of the boats in use on the Great Lakes are sufficiently large for ocean service. The ships will have to be taken out of the St. Lawrence before December, and it is reported that many railroads are now offering their vessels for sale to be delivered to the purchaser before traffic closes in the winter on the St. Lawrence River.

Presentation of Flag.—The Great Lakes Transportation Co., on April 24, was presented with a large Dominion flag by the Town Council of Midland, Ont., for its steamer Glenshee. The presentation was made by Mayor Craig, who expressed, on behalf of the council and citizens generally, their high appreciation of the services rendered the town by the company, and particularly by Mr. Playfair, the president, in having so many boats winter there, providing labor for many citizens, together with the thousands of dollars expended by the company for supplies. Mr. Playfair, in reply, expressed his gratification at the kindly feeling that existed, and said the company hoped to still add to its fleet of steamers, and thereby further the interests of the town as well. Mr. White, a partner of Mr. Playfair, followed. Short speeches were also delivered by other members of the council and W. Finlayson. The Glenshee is the old steamer Hannah, wrecked in the big storm two years ago and purchased by the Great Lakes Transportation Co. She was brought here last fall for repairs, and has given employment to a large staff of men all winter. The company has eight other boats which, with the Hannah, have been painted a battleship grey and re-named, each having the prefix "Glen."

VESSEL LOSSES OF THE WAR.

FROM the statistics published by Lloyd's Register of Shipping, it is to be noted that a total of 152 steamers and 60 sailing ships have been removed from the Registed for various causes during the quarter ended December 31st last. The aggregate tonnage of these vessels amounts to 273,720 gross tons in the case of steamers, and 46,310 net tons in the case of sailing ships. The greater part of the loss is accounted for by the war, 68 steamers, totalling 153,513 gross tons, and six sailing ships, making 11,683 net tons, having been sunk by warships or mines.

As would be expected, Great Britain has been the greatest sufferer in this respect, 36 steamers, of 95,552 gross tons in the aggregate, and one sailing ship, of 1591 net tons, having been sunk by the enemy, who have also sunk two Colonial ships; one of the latter was a steamer, of 473 gross tons, and the other a sailing ship, of 1798 tons net. Of our Allies, France has lost one steamer, of 4803 gross tons, and four sailing ships, making 8294 tons net together, while Russia has lost four steamers, totalling 3853 gross tons.

Nine enemy ships have been sunk by Great Britain and her Allies, seven of them being German steamers, with a total tonnage of 28,348 tons gross; the other two were Austrian steamers, totalling 1399 gross tons. Among the neutral nations, Sweden sustained the heaviest losses, seven Swedish steamers, with an aggregate tonnage of 7341, having been sunk during the period under consideration. Norway comes next with five steamers, making 5566 gross tons together, and Denmark and Holland follow; these countries have each lost two ships, with an aggregate tonnage of 3038 and 2382 gross tons respectively. Only one other loss due to the war is recorded, and this was a small steamer, of 758 gross tons, owned in Persia.

It should be mentioned that, in compiling the statistics from which the particulars given above have been extracted, Lloyd's Register does not include steamers of less than 100 gross tons, or sailing ships of less than 100 net tons.

Life on a Submarine.—A German commander states:—When running under sea there is a death-like silence, as the electric machinery is noiseless. It is not unusual to hear the propeller of a ship passing over us. We steer entirely by chart and compass. As the air heats, it gets poor and becomes mixed with the odour of oil: the atmosphere becomes fearful. An overpowering sleepiness often attacks new men. Day after day spent in such cramped quarters, where there is hardly room to stretch your legs, and constantly on the alert, is a tremendous strain on the nerves. I have sat or stood eight hours on end with my eyes glued on the periscope and peered into the brilliant glass. When the crew is worn out, we seek a good sleep and rest under the water before ascending, I always order silence for several minutes in order to determine by hearing, through the shell-like sides of the submarine, whether there are any propellers in the vicinity.

THE DECLINE OF THE SAILING SHIP.

A GLANCE backwards through the returns of Lloyd's Register for the last few years brings out prominently the fact that the sailing ship is fast disappearing from the seas. If we take the year ending June 30, 1910, we find that the total number of sailing vessels—British and foreign—on the Register was 1,132. A year later the figure was 1,044; at the end of June, 1912, it was 949; and at the end of June, 1913, it was 921—a reduction of over 18½ per cent. in the four years. During the same period the tonnage declined from 1,725,834 to 1,408,563, and the ratio of sailing vessels to steamships went back from 9.2 to 6.6, the steam tonnage in 1910 having been 18,782,708, and 21,256,060 in 1913.

Were this rate of decrease in sailing vessels to be continued it is obvious that such ships would soon disappear altogether, but it is not certain that such a condition of affairs will actually arise for many years to come. There is still a good bulk of trade in cargoes with which time is not such an important factor as cheap conveyance, and for such cargoes there is still a call for sailing vessels. Moreover, the fully rigged ship or barque when properly handled and under favorable circumstances has a by no means negligble speed, and there are some voyages which may, occasionally at any rate, be made at as fast a rate, or nearly so, as that of a tramp.

However, for such cargoes there will quite possibly be a diminution of demand for vessels using sails alone, though, as we say, we do not anticipate that the demand will die away entirely for a long time. When it does so the reason will probably be that the self-propelled ship is safer and more easily handled and not necessarily because it is faster. Numbers of sailing ships each year set out on voyages and never reach their destination. No more is heard of them. There are, of course, steamships which suffer the same fate, but, considering the relative numbers of steamers and sailing vessels engaged in trade, the percentage of the former lost to the total in use is not anything like as large as of the latter. Moreover, there is, in using a self-propelling vessel, the added advantage that all kinds of cargo can be carried whether they require to be transported quickly or whether a slower speed would suit as well.

Auxiliary Power Feature.

A fact which makes for the continued existence of the sailing ship is the development of the internal combustion engine used as an auxiliary. Many important sailing vessels have already been fitted with this secondary means of propulsion, and we may expect to see many more so fitted in the near future. The extra capital cost, taken together with the additional expense in running, should be more than counterbalanced by the reduced length of the voyage and the increased safety, with reduced insurance risks. The whole matter is, of course, dependent on dollars and cents, but it should be noted that the price of oil is a matter of far less moment in an auxiliary ship than in one which depends wholly for her propulsion on internal combustion engines. Many voyages may be made without using any fuel at all, so that the cost per ton-mile distributed over a whole season is quite small.

Again, to turn for a moment to another aspect of the question, it should be borne in mind that Lloyd's returns do not include vessels of under 100 tons. Did they do so, the figures above quoted would have to be greatly modified, for during recent years the numbers of small fishing smacks and boats which have either discarded sails altogether in favor of motors, or have installed motors to aid the sails, have been very large. The tendency is undoubtedly to continue this practice, and hence another class of sailing vessels is doomed to extinction or to modification. These changes, however, will have no adverse effect on shipbuilding. The days of the wooden seagoing vessels are nearly done. Steel-hulled sailing vessels have supplemented the wooden structures, and they are built in the same yards as steamers and motor ships. The small structural alterations for the conversions necessary can be made in these yards, so there is no fear of work being transferred from one district to another.

Sailing Vessel Dies Hard.

If the sailing vessel is dying, however, it is dying hard. The average size of the units at present in existence has not decreased, though new tonnage may not perhaps keep up the proportions. The average size of the vessel existing in 1910 was 1525 tons. Last year it had not become less, but was, as a fact, a shade more, being 1529 tons, and there are large numbers of sailing ships of about this tonnage, and between it and 2000 tons. In them, voyages such as that to Australia without a stop and possibly without sighting land are made; and, barring accidents, they fulfil their duties admirably. It is the custom to work them with comparatively small crews, but with a number—sometimes ten or twelve—of apprentices. It is from this source that many of the officers in the merchant service—not only for sailing ships, but for steamers—are recruited, and there could be no better training than it affords.

From this point of view alone it would be a great pity if the sailing vessel were to disappear entirely. In this period of three years service, the lads, albeit with the accompaniment of many hardships, get such a grounding in seamanship as would be quite impossible to gain in any other manner in a like time. The very hardships are in the nature of a blessing in disguise. The lad who during his apprenticeship has been round the Horn, say three or four times in a sailing vessel or even with an auxiliary ship, would regard the discomforts met with in steam or motor ships in the same or less inclement latitudes with comparative indifference. In spite of all that has been said, however, there are only too many signs that the sailing vessel has ultimately got to go, and it is only necessary to look at the number of ships now under construction to realize this. In Britain alone, there are 470 steamships and only 16 sailing vessels now being built. These figures require no comment.—The Engineer.

LIGHTING A BOILER FIRE

IT may often be noticed when starting a fire in the ordinary way—that is, without covering the grate with fuel—the fire takes a good long time to get up. The proper way to start a fire is to cover the whole of the grate with coal in order to stop the flow of air through it as much as possible—that is, as much as if there was a fire over the whole of the grate. If this is not done, then, as soon as a draught is formed by heat getting to the chimney, the air flows freely through the bare grate, and the small fire that has been started gets no draught of any strength and burns up slowly. If, however, the grate is choked with coal or, better still, paper is laid over it and covered with coal, and a little place is left free on which to start the fire, there will be a strong draught through this little fire, and, as the coal beyond catches alight, the paper sheet will burn away and admit air just when wanted and gradually as the fire spreads. In this way a fire may best be quickly lighted.

Warfare New Style.—A party of some 200 French infantrymen set out to recapture a trench recently. They were provided with small, powerful electric torches, which when quite near they switched on. Immediately the enemy started a bombardment. The range was but a few yards, and the Germans used hand grenades and air darts. The grenades made much noise, but were harmless. The dart were more serious. Fired by special guns, they came through the air with much force and inflicted bad injuries. The Germans were cleared out of the trench with the bayonet.

ASSOCIATION AND PERSONAL

A Monthly Record of Current Association News and of Individuals Who Have Been More or Less Prominent in Marine Circles

James A. Reid has been appointed custodian of the recently opened new dock at Windsor, Ont.

George E. Francklyn, agent for Lloyd's underwriters, died at Halifax, N.S., on May 2. Mr. Francklyn, who was 67 years old, was a grandson of Samuel Cunard, founder of the Cunard Line.

GERMAN SUBMARINES.

THE Italian naval review Rivista Marittima, gives in its issue for March an abstract of an article written by a German officer, according to which the German submarine U 47 completed her trials in February last. The number of submarines in the service at the opening of hostilities was 27. Adding those then in course of construction for Germany, the number reached 36. New units have been put down since the war was declared, besides those then in course of construction for foreign governments. The crews for submarines, when not in action, are quartered in hulks which are anchored in German waters. When a submarine leaves for a cruise she is so filled with stores and fresh water that only a very narrow passage remains free. Naptha exudes at the steel bulkheads, doors and throughout the whole ship, this lending confirmation to the rumor that the water-ballast tanks, which, though watertight, are not oil-tight, are also filled with oil. The crew of the U 47 and similar units number 30 men. The men's quarters are forward in the torpedo-launching room, and aft in the electric-motor room; the height of these rooms at the centre line of the ship is about 3 m. (9 ft. 10 in.).

The same review deals elsewhere with the radius of action of the German submarines and states the following: If we consider an 800-ton submarine, propelled by Diesel engines, and having a cruising speed of 8 knots on the surface, the power deveolped does not exceed 250 h.p. and the oil fuel consumption is at most 10 kg. per mile. On this basis, for every thousand miles, the oil fuel consumption is 10 tons. Considering that the boat probably carries a normal supply of 50 tons, she would have a radius of action of at least 5,000 miles, equivalent to over 600 hours of constant navigation at 8 knots. If, moreover, the water-ballast tanks be filled with oil, the very great increase in radius of action thereby appears now to be limited only by the powers of resistance of the crew.

CENTRIFUGAL BOILER FEED PUMPS

THE points which are claimed to make the centrifugal pump superior to the reciprocating are better steam economy, simplicity and ease of operation. It requires no expert to keep it up to the standard, as there are no steam valves to be set, no indicator cards to be taken, and no valves or seats to replace. The impossibility of building up an excessive pressure insures no undue strains on the piping. In a properly designed centrifugal pump it is impossible to build up a pressure in excess of a predetermined head, which is known as the shutoff pressure, and beyond which the pressure will not go.

One of the most important points, however, is the entire absence of shock or pulsation. The pressure is built up gradually and when the boiler feed regulator opens there is no hammer in the line, the pressure being always ready to force the water into the boilers without the necessity of going through the operation of a pump governor, and without the speeding up of the pump, as is the case with a reciprocating unit. Another point is that, in case the water should become too hot or should not flow, there is no danger that the centrifugal will wreck itself, as would be the case with a reciprocating pump. Vibration is also absent, consequently light and inexpensive foundations only are required for a turbine — driven centrifugal pumping unit; incidentally this means a very small amount of floor space required.

LICENSED PILOTS.

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Captain Walter Collins, 43 Main Street, Kingston, Ont.; Captain M. McDonald, River Hotel, Kingston, Ont.; Captain Charles J. Martin, 13 Balaclava Street, Kingston, Ont.; Captain T. J. Murphy, 11 William Street, Kingston, Ont.

ST. LAWRENCE RIVER, BAY OF QUINTE, AND MURRAY CANAL.

Captain James Murray, 106 Clergy Street, Kingston, Ont.; Capt. James H. Martin, 259 Johnston Street, Kingston, Ont.; John Corkery, 17 Rideau Street, Kingston, Ont.; Captain Daniel H. Mills, 272 University Avenue, Kingston, Ont.

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A. J. Ross, Halifax, N.S., Grand Doorkeeper.
James Gillie and A. E. Kennedy, Kingston, Ont., Grand Auditors.

1915 Directory of Subordinate Councils, National Association of Marine Engineers.

Name.	No.	President.	Address.	Secretary.	Address.
Toronto,	1	Chas. M. Arnott,	94 Hanley Street	J. S. Adams,	631 Gladstone Ave.
St. John,	2	G. J. McVicar,	49 Winslow St. West	G. T. G. Blewett,	36 Murray St.
Collingwood,	3	Wm. Whipps,	Collingwood, Ont.	Robert McQuade,	Collingwood, Ont.
Kingston,	4	L. E. Spencer,	24 Clergy St.	James Gillie,	101 Clergy St.
Montreal,	5	Henry Lamereaux,	280 St. Andre St.	O. L. Marchand,	278 Clark St.
Victoria,	6	John E. Jeffcott,	Esquimault, B.C.	Peter Gordon,	808 Blanchard St.
Vancouver,	7	W. G. Wooster,	Room 10, Jones Bldg.	E. Read,	Room 10-12, Jones Bldg.
Levis,	8	Michael Latulippe,	Lauzon, Levis, Que.	S. G. Guenard	Bienville, Levis, Que.
Sorel,	9	Nap. Blandon,	Sorel, Que.	Alf. Charbonneau,	Box 204, Sorel, Que.
Owen Sound,	10	John McLeod,	570 4th Ave.	J. Nicoll,	714 4th Ave. East
Windsor,	11	Alex. McDonald,	28 Crawford Ave.	Neil Maitland,	921 London St. W.
Midland,	12	Geo. E. Wilson,	P. O. Box 204	Roy N. Smith,	Box 178
Halifax,	13	Robt. Blair,	29 Preston St.	Chas. E. Pearce,	Portland St., Dartmouth, N.S.
Sault Ste. Marie,	14	Charles H. Innes,	27 Euclid Rd.	Geo. S. Biggar,	43 Grosvenor Ave.
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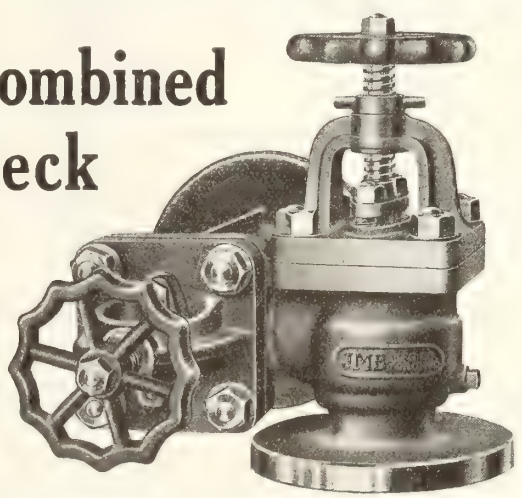
is the Engineer's saving device, as Check Valve can be repaired while steam is up. Full area constant through every part.



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Adjusting spindle of check valve can be locked in desired position.

All parts interchangeable.

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FIRING A SUBMERGED TORPEDO.

THE main armament of a large warship consists, as everyone knows, of guns; but it is not so generally known that the submerged torpedo tube is a part of the auxiliary armament of every large war vessel. The battleship's torpedo tube is always situated well below the waterline, and it is fixed relative to the ships. In the earlier submerged tubes efforts were made to train them, but the idea involved so many complications that it was abandoned, and fixed tubes are now universally fitted.

The Torpedo Tube.

The torpedo tubes themselves consist of a cylindrical vessel, one end of which is attached to the ship's side, and fitted with a sluice valve. The tube is loaded either through the end, or, as in most of the later types, at the side. Elaborate arrangements are provided to prevent the possibility of the torpedo being discharged until the valve at the ship's side is open, and the tube is in communication with the sea. It is also impossible to open the end door of the tube, if the sluice valve is not shut.

Discharging the Torpedo.

The torpedo is discharged from the tube either by means of compressed air, cordite, or powder. If the ship were travelling at a high speed when the torpedo is fired, the nose of the latter would be twisted round, and its tail would probably jam in the valve. To prevent this, a bar or spoon is made to project out from the ship's side to guide the torpedo until it is clear of the hull. This bar is either run out just previous to firing, or else it is fired out at the same time as the torpedo, and returns automatically after the torpedo has left.

To discharge the torpedo at the right instant, it is obvious that the firing must be done some distance from the tube itself, from a position where the target can be observed. A firing director is usually fitted in the conning tower. This consists of a sighting device and a firing key. At the right instant the key is pressed, and an electric current does the rest. The firing director is provided with arrangements for making the necessary allowances for the estimated speed and course of the enemy, and the speed of the torpedo itself, the latter being different for different ranges.—Liv. Journal of Commerce.

German Blockade.—During the eight weeks since submarines have attacked merchant vessels, they have sunk one out of every 470 arriving at or sailing from British ports, or less than 0.25 per cent. In the mercantile marine trading abroad there have been no losses.

Canadian Vessel Captains and Chief Engineers

Through the courtesy of the various Steamship Companies, we are enabled to give a list of 1915 season vessels, together with the names of their principal officers.

RIDEAU LAKES NAVIGATION CO., KINGSTON.

Vessel.	Captain.	Chief Engineer.
Rideau Queen	Ed. Fleming	Thos. Hazlitt

CAN. PAC. CAR & PASSENGER TRANSFER CO., PRESCOTT.

Vessel.	Captain.	Chief Engineer.
Charles Lyon	W. Henry	L. Black

C.P.R. BAY OF FUNDY SERVICE, YARMOUTH.

Vessel.	Captain.	Chief Engineer.
St. George	M. Cardiff	J. T. Kelly
Yarmouth	A. MacDonald	J. M. Pendrigh

NIAGARA, ST. CATHARINES & TORONTO NAVIGATION CO., ST. CATHARINES.

Vessel.	Captain.	Chief Engineer.
Dalhousie City	J. W. Maddick	J. H. Brown
Garden City	G. Blanchard	H. R. Welch

NORTH VANCOUVER FERRY CO., NORTH VANCOUVER.

Vessel.	Captain.	Chief Engineer.
Ferry No. 1	W. Fatke	L. H. Clark
Ferry No. 2	R. Spicer	D. Becker
Ferry No. 3	W. J. Spracklin	J. W. Whitworth

CAN. NORTHWEST STEAMSHIP CO., TORONTO.

Vessel.	Captain.	Chief Engineer.
Atikokan	W. J. Brown	C. Arnberg
George A. Graham	P. McIntyre	J. H. Louden
Neebing	John Ewart	R. R. Foote
Paipoonge	J. N. Foote	H. H. Moore

ST. LAWRENCE & CHICAGO STEAM NAVIGATION CO., TORONTO.

Vessel.	Captain.	Chief Engineer.
E. B. Osler	C. E. Robinson	W. Robertson
G. R. Crowe	J. H. Hudson	W. Reid
Iroquois	D. A. Kennedy	J. E. Readman
W. D. Matthews	W. Cunningham	W. Harwood
J. H. G. Hagarty	S. Hill	C. Robertson

MATTHEWS STEAMSHIPS CO., TORONTO.

Vessel.	Captain.	Chief Engineer.
Easton	D. N. Laroche	J. T. Myler
Edmonton	H. Maitland	J. G. Fisher
Masaba	J. A. Smith	W. Whipps
Yorkton	.....	D. McKenzie
Steelton	W. J. Kirkwood	J. A. McGill

KEYSTONE TRANSPORTATION CO., MONTREAL.

Vessel.	Captain.	Chief Engineer.
Keybell	J. J. Murray	E. W. Sparling
Keynor	Jas. Martin	John Robertson
Keyport	J. Mullen	R. J. Muchmore
Keyvive	G. Bunting	James Boak
Keywest	M. Olsen	W. H. Jennison

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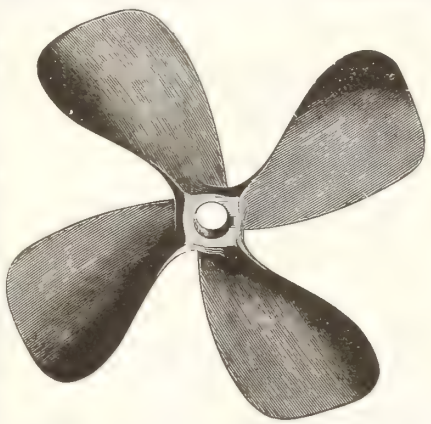

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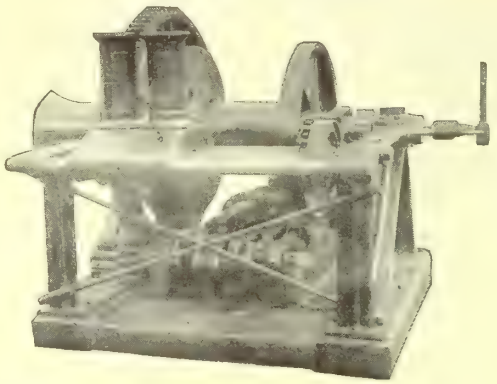

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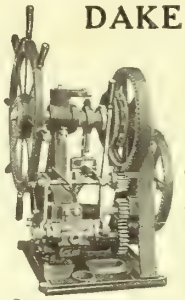

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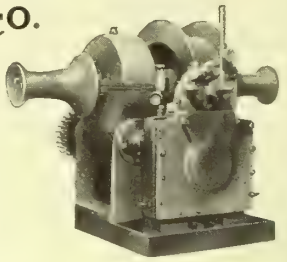

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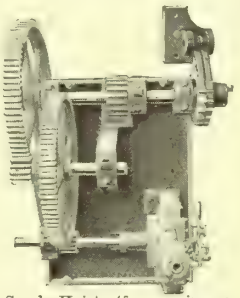

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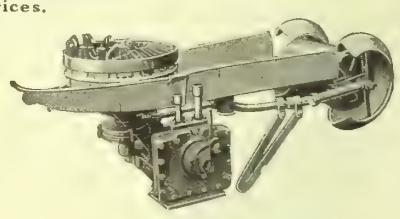

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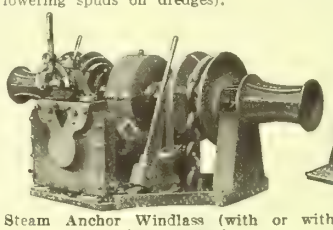

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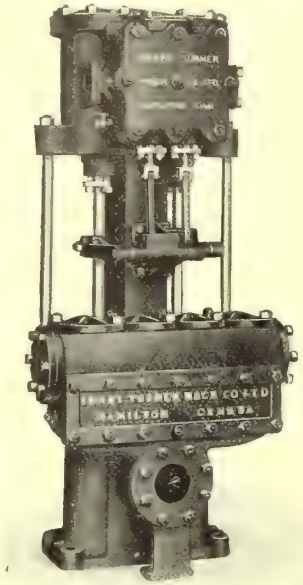

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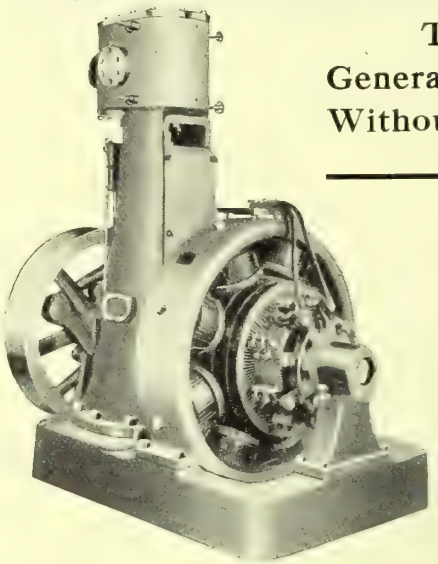

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The Publisher's Page

By B.G.N.

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Submarine Craft Development and Up-to-Date Efficiency*

By T. B. Abell**

During the past few months, enemy submarine craft have been very much in evidence, and not only have those in charge of their legitimate prey been kept more or less on the rack, but those of their brethren in the merchant service as well. In view of the fact that many readers of our journal have perforce to trade in the war water zone during these summer months, it seems opportune to place at their disposal all available information concerning both the offensive and vulnerable features of this highly developed naval fighting machine.

FIFTEEN years ago the submarine was looked upon in official quarters in England as a weapon which, if used in warfare at all, would be used only by the weaker nations, and then as a weapon for defence of a maritime Power which would, from its position among the Great Powers, have to act on the defensive only. It was admitted that if it ever became a practical vessel the Power which possessed it would cease to be weak and become really strong.

Events of the past few months have shown us that the submarine has become practical, has proved itself really powerful, and its power has been indelibly impressed upon our minds. The submarine of Jules Verne, in his "Twenty Thousand Leagues Under the Sea," has materialized, and become a terribly real and almost living thing. Its evolution has not been rapid, as the story of its development is a long and romantic one, covering a period of about three centuries. It is one long tale of strenuous endeavor, sometimes stimulated by worthy ideals, at other times by base ones, of disappointment, of suffering, of poverty and sacrifice not only of material things but also of life.

The inventor has been encouraged to experiment by one government, and his efforts laughed at by its successor. He has been robbed of his ideas, and then turned adrift as an imposter and a crank. Put on a footing similar to a spy by one Power, by another whose moral outlook was of a different order, granted a title of nobility, an action which was regretted a short time after it was performed.

The outcome is that many difficulties have been overcome, that a practical terrible weapon of war—not of peace, for it is most improbable that merchandise will ever be transported under water—has been evolved. All the men of many nationalities who have endeavored to solve the problem of under-water propulsion have by their failures only in less degree than by their successes contributed to the realization of this insidious weapon of great and uncanny precision. The difficulties to be overcome which have taxed the powers of the inventors and engineers to the utmost during the past 150 years, and have only during the last 15 years been brought to a really successful issue, are as follows:

Difficulties Faced.

1.—To design the hull to be strong enough to navigate with safety at great depths should circumstances require it, in any case not less than 100 feet.

2.—To enable it to go completely under the water either when stationary or when in motion, and to be able to get under quickly in order that a foe which has observed it while on the surface will have small chance of attacking at close range before it can completely submerge.

3.—To make provision for returning quickly to the surface in case of mishap to machinery.

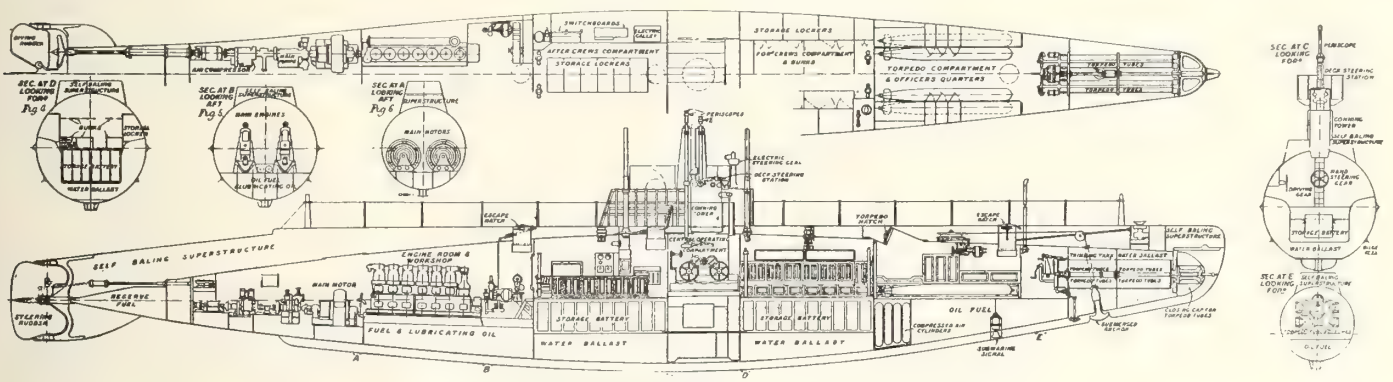
4.—To enable it to proceed at an even depth line for a long distance, and to place it under perfect control both in the vertical and the horizontal planes.

There are certain characteristics of fishes which guide us in designing a submarine. The salmon, which is able to proceed at a high speed through the water and to make rapid evolutions in it, is, perhaps the best model. The salmon has a blunt head and a sharp tail; it has a smooth and fair exterior, with very few excrescences tending to impede its motion; its propeller is placed at the tail; it has a reserve of buoyancy to enable it to rise to the surface rapidly (this being effected by muscular effort); it has a fixed centre of gravity. All these features are embodied in the submarine.

In the system of control, the submarine falls far short of the salmon. The screw propeller cannot hope to realize the efficiency of the salmon's tail, which acts both as propeller and rudder for motion in both vertical and horizontal planes.

Historical.

One of the earliest mentions of a submarine is by an Englishman named Bourne in 1578—337 years ago. It is not recorded that the boat he describes was ever built, though from his description of the methods of overcoming some of the difficulties of the problem it would almost appear that he had made experiments either with a ship or a model of one. It is an ordinary shaped boat having two watertight decks. For a portion of the boat's length and between the two



MODERN TYPE SUBMARINE DESIGN AND LAYOUT—I.

*From a lecture delivered before the Liverpool University Students Engineering Society.

**Professor of Naval Architecture, Liverpool, England.

decks was a watertight compartment whose sides could be moved in or out transversely as required. Abreast the compartment holes were bored in the ship's side. These were closed when the moveable sides were fully extended and when the ship was required to float on the surface. On moving-in the sides, water was admitted to the interior, the boat's buoyancy was destroyed and she was submerged. This method of submergence by altering the shape of the buoyant portion of the ship was embodied in a submarine built as recently as 1885.

VIEW OF SUBMARINE FULLY SUBMERGED, RUNNING AT 10 KNOTS AND SHOWING TWO PERISCOPES. (Cut courtesy of "Syren and Shipping.")

Bourne recognized that the weight should be concentrated low down in the boat, and this is an important point, which is not a feature in an ordinary ship.

Symons.

Symons, in 1747, built an ordinary shipshaped boat, decking her in so that the deck could withstand water pressure at a working depth. Submergence was obtained by a somewhat rough method, but by a principle which is identical with that of the present day. Water was admitted to bottles of leather having their necks attached to the ship's side. When sufficient water had been admitted to bring the boat awash, the necks were tied by string to stop the flow. To rise to the surface the necks were opened, and water expelled by hand pressure, actually by squeezing the bottles. This method was too rough to be practicable, and in modern submarines the bottles are replaced by sealed tanks with valves, the pressure being applied by compressed air. Although the pieces of string are replaced by valves, the valves are still worked by hand, it being the most reliable method. Symons' boat was really a surface boat sealed down, because had it been lowered to a very moderate depth it would have been impossible to expel the water by hand power.

Another type was that constructed by Day, an ingenious ship's carpenter, who built a diving boat. It had no means of locomotion. He appears to have been the first to have used a detachable weight or ballast for bringing the boat to the surface. He successfully rose from a depth of thirty feet in the Broads near Yarmouth, and again in Plymouth Sound, but on making a further experiment there in 22 fathoms of water the boat collapsed and Day perished.

Bushnell.

Wars always stimulate the inventive genius of the belligerents. During the American War of Independence, Bushnell, a graduate of Yale College, seeing the serious dislocation of trade caused by the blockade of the English fleet, gave all his energies to devise some weapon for destroying the enemy, and when war broke out in 1774 he designed a submarine boat which would enable a gunpowder charge to be placed against the most vulnerable part of a vessel, i.e., below the waterline, and to explode it from a distance without endangering the lives of the operators inside the submarine.

It was roughly egg-shaped, a form capable of resisting great external pressure, and was strong enough to enable him to descend to great depths had he so desired. It was ballasted by 700 lb. of lead, 200 lb. of which could be released from inside in case of emergency without the boat departing from its upright attitude. To submerge, water was admitted through a valve operated by the foot to a tank which when full just brought the top of the boat level with the surface. Small quantities of water could then be admitted to further sink the vessel. If she began to fill rapidly, water could be ejected by a small force-pump until there was a very small upward force tending to restore her to the surface. When this state of affairs was realized she was ready for operation.

She was manoeuvred by two hand-driven screw propellers. With one of these the small force of buoyancy could be overcome and the boat lowered to the desired depth. The second one in front of the boat gave motion ahead sufficient to enable her to move across a harbor or manoeuvre around a hostile ship. With practice a skilled operator could manoeuvre the boat fairly well, and in suitable circumstances considerable distances could be traversed.

On the outside of the submarine was a bomb containing a charge of gunpowder. To it was attached a wire with a screw at the end. The screw was intended to be screwed into the wooden hull of the enemy ship. The method of attack was to manoeuvre the boat under the warship's hull and to attach the bomb to the ship by means of the screw. The submarine then moved off, retaining electric contact with the bomb, this being exploded at a safe distance by an electric spark. These operations were nearly carried out with success, failure being only due to the oversight of an important point. The screw could not be entered, because the hull was covered or sheathed with copper. Of course, it would be impracticable to employ a submarine of this type against a moving ship.

Bushnell, in building and designing his boat, realized two important features which placed his work far in advance of an previous inventor.

1.—It was desirable to have a small reserve of buoyancy which would bring the boat to the surface naturally if the screws were stopped.

2.—It was desirable to have a conning tower placed practically over the centre of gravity of the boat.

Fulton.

Towards the end of the 18th century, Fulton was making a name for himself by his inventive genius, and in 1797 he was persuaded to go to France. He realized the importance of sea power, and considered that as the United States became more powerful and prosperous she would require a large expenditure to build a navy. If, therefore, he could design a submarine boat which would be invulnerable, "He would have the means of destroying the engines of oppression and so destroy the systems of oppression."

He formed a company which undertook to construct a boat on certain conditions, one of which was as follows:

"As in the case of fire ships, or other contrivances for the destruction of ships which are considered to be against the laws of war, the people who take part in these enterprises are hung or put to death; to prevent this the Directoire will accord to the company a commission specifying that every person made prisoner in one of the company's expeditions is to be treated as a prisoner of war, and any hurt done to them is to be met by similar reprisals on English prisoners."

This condition was a great stumbling-block to the carrying out of Fulton's proposals, but it was interesting to note as indicating the spirit in which fighting

was carried out in those days, in accordance with the naval opinion of the day, a commission was refused on the ground that such a method of waging war was unworthy of the French honor. Napoleon was, however, much taken with Fulton, and he eventually licensed a grant for the construction of a boat named "The Nautilus." She was completed and had satisfied a commission appointed to witness her trials. Then Fulton offered to build a new boat if they would grant him a commission. Their conscience would not permit them to do this, and Fulton came to try his luck with England, the nation which he had been trying to subdue just previously, but his proposals were strenuously opposed by the Admiralty.

Fulton's boat did not differ much in principle or in mode of attack from Bushnell's. The small force of the reserve buoyancy was overcome when the boat was under way by horizontal rudders, and these were also the means of keeping her in a more or less horizontal path. This was quite a new feature, and is used in present-day submarines.

Bauer.

A further important step was made when Bauer, a Bavarian, made a submarine to attack the Danish fleet, which so recently as 1864 was blockading the coast line of Germany. He was the first to really make use of the speed of the vessel to submerge it against a definite and sufficient reserve of buoyancy. The boat was made to dive by manoeuvring a heavy weight inside the boat, and, by manipulating the weight, the boat performed a series of evolutions closely resembling those of a porpoise just breaking the surface. The moral effect of this vessel was considerable, for the enemy's ships, instead of being able to stand close in shore, were compelled to remain in the offing. Bauer's boat thus proved itself a practical weapon of offence.

French and Spanish Submarines.

About 1860 the French and Spanish turned their attention to submarine boats and by this time were able to replace the hand-worked by a power-driven propeller. A boat was built by Peral successfully, but it had not sufficient control in the vertical plane. In this case the control was obtained by two screws working on a vertical axis and driven by motors supplied with current from a set of accumulators. The other features of the vessel were fitting of a torpedo tube for firing Schwartzkopf torpedoes, and the use of compressed air for the manipulation of the ballast.

Liverpool has played its part in the development of the submarine. In 1878 Mr. Garrett, a curate in Liverpool, diverted some of his energies from the direction of peace to that of war, and in this year built a submarine boat. It was hand-propelled, for the final adjustment of the ballast water there was a small cylinder, in which worked a screw-operated piston, enabling the buoyancy to be nicely adjusted. This is similar in principle to that proposed by Bourne in 1578, 300 years previously. The hydroplanes for controlling the vertical motion were situated at the forward end of the boat. A second boat, power driven, was built by Cochrane & Co., of Liverpool. Several successful trials were carried out with it in the Birkenhead Float in 1879. This boat embodied practically all the principles of the modern submarine, and only differs from it in the method of application, and in a greater perfection of detail.

Submergence against an appreciable reserve of buoyancy by means of the speed ahead and by hydroplanes was the secret of successful submarine navigation, and this method has been evolved by a gradual, though almost continual development. The problem had not been solved by any one man or by men employed in any one branch of engineering. With the improvements in mechanical and electrical engineering suitable prime movers had been obtained, and the control of the vessel had been rendered more easy. It can be said of the modern submarine that it is a safe method of moving on or underneath the water, and in times of peace, i.e., taking ordinary risks, is at least as safe as the ordinary surface ship. The great perils which have to be faced are those brought about by failure in the human element of control.

Holland Submarine.

In the British Navy at the present time there is practically only one type of submarine actually in being. It has been developed from the boat designed by an American named Holland. His first boat was built in 1875. Several boats were subsequently built, but it was not until the year 1896 that it was demonstrated that a full size submarine could be constructed fulfilling the many and varied requirements of war.

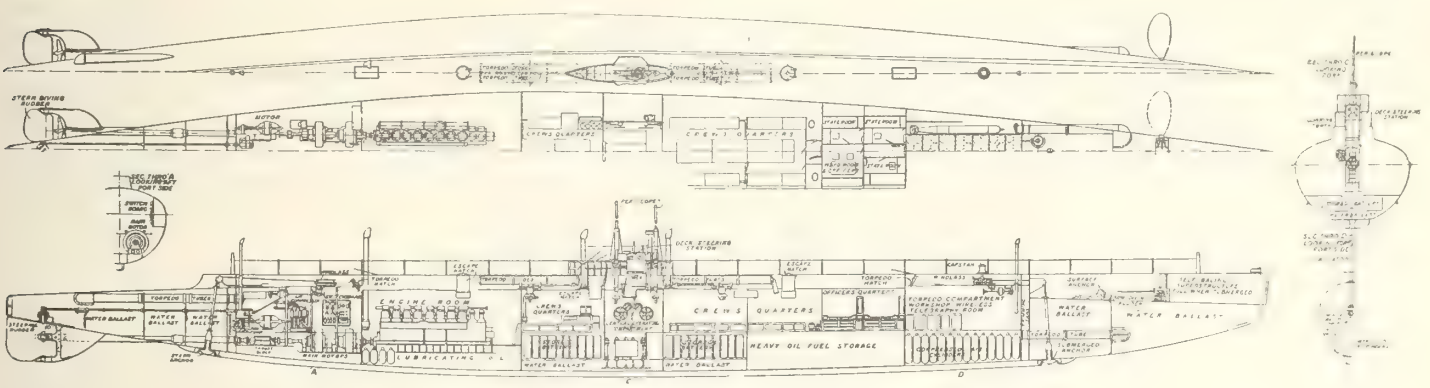
This boat was 54 ft. long, 10 ft. 3 in. in diameter, and 175 tons in weight when floating on the surface and unballasted. It was driven by a petrol engine of 50 h.p. at a speed of seven knots. Submerged, the engine could not be used on account of the difficulty of supplying air for combustion, and propulsion was effected by an electric motor supplied from accumulators. The armament consisted of one bow and one stern torpedo tube, and also a dynamite gun.

Recent submarines are driven in a precisely similar manner, except that the petrol engine is replaced by a heavy oil engine of the Diesel type for surface running. The surface speed is anything up to 16 knots; when submerged it is about 10 knots.

Submarine Ballasting.

In the surface condition there is a reserve buoyancy of about 10 per cent. of the submerged displacement, i.e., a boat of 200 tons submerged displacement would carry when submerged very nearly 20 tons of water ballast. This would have to be removed to bring her to the condition in which she would be when travelling on the surface with the conning tower hatch open, or what is known as the surface condition.

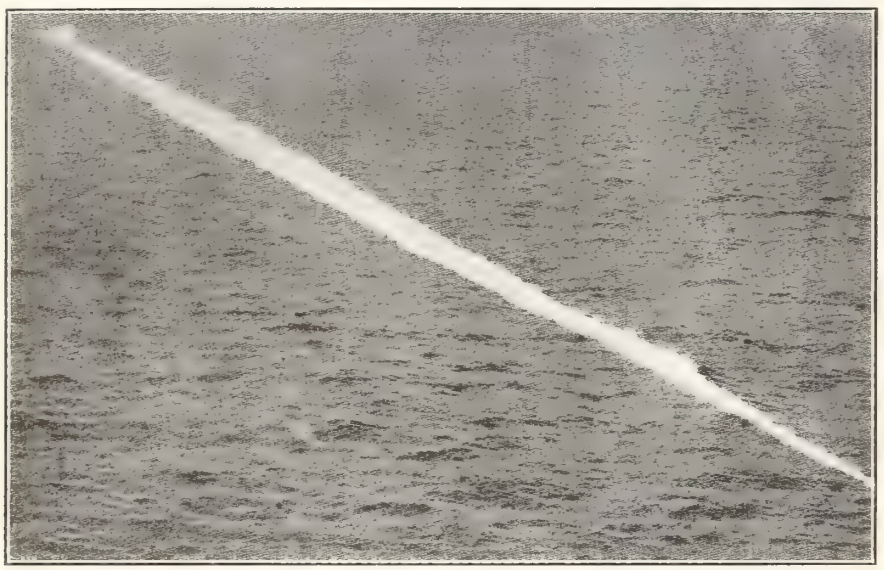
The ballast is stowed in a number of



MODERN TYPE SUBMARINE DESIGN AND LAYOUT—II

tanks—the main ballast tank, the auxiliary ballast tanks, the fore and aft ballast tanks for trimming purposes, the compensating tanks, and the buoyancy tank. The main ballast tanks are completely filled when preparing to dive. The auxiliary tanks are partially filled. They are used for adjusting the total amount of ballast required to allow for any change in weight of the boat due to alteration in the number of the crew, to consumption of stores, oil fuel, etc.

The trimming tanks are small, two in number, and are placed one at each end of the ship. They are connected together so that water may be blown from one end to the other if required to bring the ship to a level condition. The total quantity of water contained in them is rarely altered. The compensating tanks provide for the admission of water to compensate for any sudden loss of weight, such as the firing of torpedoes. The buoyancy tank has a capacity approximately that of the conning tower and the top-side fittings.



WAKE OF A TORPEDO FIRED FROM A SUBMERGED SUBMARINE.
Cut. Courtesy of "Syren and Shipping."

To Submerge.

By adjusting the water level in the various tanks, the boat is lowered until she floats level, with the base of the conning tower just awash. There is then only a reserve buoyancy of about three pounds per ton of total weight of the boat. When the engines are started and speed is got up, the boat is submerged by depressing the hydroplanes. Her nose dips, her tail kicks up, she gradually gathers way downwards or takes up depth, and is finally submerged so as to leave the periscope about 4 feet above water.

Rising to the Surface.

The boat will rise if the engines or motor be stopped, if the helm is put hard down, if the main ballast tanks are blown by means of the compressed air supply.

When rising, the remaining tanks are left as far as possible undisturbed, for the vessel can then readily be brought to her correct diving condition by filling the main ballast tanks only. This is an important feature, because as a rule it takes a considerable time to adjust the ballast for diving condition in the first place; it may take as long as twenty minutes, and has generally to be carried out when the boat is at rest. These operations are simple in character, but require to be carried out with considerable care.

When starting to ballast the boat, there is a large volume below the surface and only a very small portion above the surface, or a very small reserve of buoyancy. If the submarine is disturbed, it will take up large oscillations in the vertical plane, and these will take some time to die out, the total weight of the vessel being so large and the restoring force so small. This type of oscillation is called by the men pumping. It was referred to in one of the reports from the commodore of submarine flotillas in connection with the recent scouting work carried out by submarines off Heligoland.

Stability.

It requires very little movement of weights on board to make the submarine take up large angles of heel when in the submerged condition. For this reason it is necessary to compensate with some degree of accuracy for the loss of weight due to the discharge of torpedoes by adding water ballast, and for the same reason to keep the crew in practically fixed positions when any important operation is in progress. To give an idea of the tenderness, i.e., readiness to heel or incline, if in a boat of 280 tons the crew of 15 men were to walk from one end of the boat to the other she would heel through 30 degrees. In an ordinary ship floating on the surface this angle would be reduced to only one-fifth of a degree for a similar but proportionate movement. At sea then, the men have to keep to their stations, and those in charge of the valves to the ballast tanks have to sit at them when the vessel is submerged so as to be ready for any emergency during important evolutions.

Steering.

Both the oscillatory, vertical and angular movements are controlled by the horizontal rudders, which are operated by hand simply to secure reliability. With this method of operation there is less to go wrong, an important element in all submarine work as well as in warship work where a large number of the operators are only partially skilled men. All fittings have to be what is termed "fool-proof."

In most boats there are two pairs of hydro-planes, one forward and one aft, and by means of these it is practicable to so adjust things as to make the boat sink on a level keel without a characteristic diving motion. Once the boat is submerged quite a small motion of the after rudders will readily maintain the boat on a practically even keel. If there is some sea on, and it is necessary to keep the periscope above water, there is an appreciable movement in the vertical plane which cannot be controlled by the rudders, and it is then that the pumping motion becomes most pronounced. At a depth of 30 to 40 ft. this is much reduced.

To navigate the boat a set of vertical rudders is provided aft, and steering is a comparatively simple operation when proceeding on a nearly straight path. When turning quickly under helm, the submarine tends to "bank" very much as an aeroplane does when turning, and without care the boat may be made to dive when a large angle of helm is suddenly applied, but this is overcome to some extent by suitably distributing the steering rudders.

Navigation.

Navigation was, and still is to some extent, carried out by magnetic compass under considerable difficulties when the boat is submerged, because the currents of electricity from the storage batteries seriously affect the magnetic needle. On the surface things were not so bad, but even there it was not satisfactory. Now this difficulty may perhaps be overcome by the gyro-compass which, although not yet perfect, is considerably more reliable than the magnetic, and is not influenced by electric currents. In boats where the magnetic compass is still used it is almost always placed outside the boat.

The Periscope.

The periscope is the important instrument forming the eye of the submarine, enabling the navigator to see with some rather small risk of being seen. In principle it is simple; in practice it is a very complicated piece of apparatus. Its details are quite secret, and it is probable that each navy has its own particular type of instrument. Essentially it consists of a tube having at its upper end projecting through the surface a right-angled reflecting prism, through which an image of a comparatively small portion of the sea is reflected through a similar prism at the lower end of the tube into an eye piece conveniently placed for the operator, who always stands facing forward. To obtain a view of any part of the horizon the tube can be turned round in any direction in azimuth. The tube is moderately large, requiring an electric motor to turn it rapidly. With a periscope such as described, if an image of a ship right forward is erect, that of a ship right aft will be inverted. This would be most confusing to the commander, and to obviate it another prism is introduced to erect the image. This—the erecting prism—has to be rotated at twice the rate of the main tube in order to obtain a constanly erect image.

The eye-piece is arranged so that the operator gets a true perspective view of the field with slight magnification, and has an angle of vision of 50 degs., in a horizontal plane. An aeroplane directly overhead cannot be seen through the periscope. Considerable practice is required to enable this instrument to be used effectively. The periscope is not required for navigating when submerged deeply; in fact, it would be useless, as it is impracticable to see half the length of the boat in ordinary sea water. It is thus impossible for a boat to dodge the mines in a mine field.

Two periscopes are sometimes fitted in large boats, one for the use of the captain and one for an observer who is continually sweeping the horizon. The horizon, with the periscope 4 ft. out of the water, is barely two and a half miles distant.

Submarine Warfare.

The methods of submarine attack and defence are, of course, still in the making, for the present is the first war in which submarines have in any way possessed anything more than a moral force.

The object of a fleet is to render ineffective the fleet of the enemy. That is the sole objective. It is not necessary that the enemy fleet should be destroyed, although that is the best way of rendering it ineffective—any other method which fulfils this object is equally good. Similarly, in land warfare, it is not necessary or even desirable for the conclusion of the war that men should be killed, it is only necessary that they should be put out of action during the period of the war.

It is necessary to render the fleet ineffective in order to protect our shores from invasion, this could not be effected without a fleet (aerial or naval); to secure our supplies; to carry on trade with friendly countries; to maintain completely the lines of communication of an expeditionary force sent to protect our interests away from our shores, either in our colonies or in other countries. The methods by which this object is to be effected are always matters of opinion. The methods which are acknowledged—in peace time when the majority of us have good and unbiassed ideals—by all great powers as legitimate are chiefly those, which, by their previous use, have become common practice.

New weapons and methods which have been partially developed will generally be considered not legitimate, but where a weapon proves to be practical no power will refrain from the use of it unless all powers agree to do likewise. Submarine warfare had become "common practice" a century ago before it was really of any actual value as a fighting force. There is no doubt, therefore, as to its legimate use at the present time on those grounds.

A war machine must be made as effective as possible and at the same time as immune as possible from damage by the enemy. The potency of the submarine lies in invisible approach, the suddenness of attack, and immunity from damage by the ordinary means of offence, viz., guns and torpedoes of the surface ship. In essence, the submarine attack is not different from the ambush or masked battery, actually it is more than these for it can be described as an active ambush. It can establish itself within the enemy's lines in practically any position desired, and is thus more formidable than the ambush in land warfare, which requires the enemy to walk into it. The ambush has been a feature in warfare from time immemorial, and no logical objection can, therefore, be raised to similar warfare by the use of the submarine.

The submarine differs from the surface ship again in that it selects for its antagonist any surface ship which it can get near enough to attack. The larger and more powerful its antagonist the greater the possibility of success. Other small vessels operating on the surface can only fight successfully vessels of about their own size and gun power. They must fly from an enemy superior in gun power.

At first, on account of its limited radius of action, the submarine was only useful as a weapon of defence. In the present war, because the bases of the hostile fleets on the North Sea coasts lie within the radius of action of our submarines, it fulfils a defensive role only by reason of its powers of taking the offensive. The submarine is effective in narrow waters, the North Sea being narrow, in the military sense.

Offensive Power.

Respecting its offensive powers, the submarine has only one weapon of military value—the torpedo. It is fired from a tube which is fixed in the ship and placed either across or parallel to the axis of the boat, usually the latter. The torpedo tubes cannot be trained upon the object independently of the ship as the gun can be.

Suppose that the enemy ship is at rest broadside on to the path of the submarine. A torpedo, from a tube parallel to the area of the ship, will then hit the mark if the submarine can be kept on a straight path towards the ship. It is not an easy thing to keep to the straight path, because the motion of a submarine parallel to its axis is an unstable one requiring the constant use of the rudder. At long range a small angular deviation from the correct line will be sufficient to cause failure, and even with the target at rest success depends upon getting as close as possible to the target.

In the case of the moving target, suppose the effective range of the torpedo to be 1,500 yards. The average speed of the torpedo is, for this range, say, about 35 knots, and the time taken to travel this distance is 76 seconds. Suppose a 600 ft. target to be steaming at 28 knots. In the most favorable position for attack —when the paths of the two ships are precisely at right angles and the ships are approaching each other—the target will, in 76 seconds move through a distance of about 1,200 yards, i.e., six times her length across the submarine's path. In order, therefore, to score a hit amidships it will be necessary to aim at a point 5½ ship lengths ahead of the ship herself.

The information required in order to hit with some chance of success includes the speed, course, and range of the target; the submarine speed; and the point ahead of the ship to aim at. None of these things are easy to estimate through the eye-piece of the periscope, and the greater the speed of the target the greater the difficulties of estimating these factors and of hitting the target.

The chance of hitting the target decreases if the torpedo is not fired before the target approaches the minimum distance from the submarine, for from that point onwards the ship will be continually increasing the range, providing it can steam faster than the submarine herself. If the submarine is spotted before its torpedo is fired or only a few seconds afterwards a change of course, will de-

crease the size of the target and give the torpedo a stern chase, which the ship will probably win.

One of the courses open to a vessel in order to avoid submarine attack is to present her stern to the enemy, or, in other words, to cut and run at her utmost speed. A second means is to steer straight for the submarine, but there is some considerable risk in this procedure, particularly if the submarine has both fore and aft and athwartship torpedo tubes. Yet it is a greater risk in some circumstances not to attempt to ram.

In any case, the captain of the ship has to decide at once what course to pursue; there is no time for deliberation, and a decision must be arrived at in a few seconds. This is just as true of those in charge of the submarine. Rapidity of making a sound decision is an extremely vital quality required of the submarine officer.

As a defence against submarines gunfire is practically useless, and without reflecting in any way upon the gunner of the Birmingham, there is no doubt that he was very lucky to hit the German submarine. No shot from a high velocity gun goes any distance below the water on its first impact, except at "long" range, and a submarine can always succeed in getting within a "short" distance of a stationary ship. Then without the lucky hit the ship is practically doomed.

Only a shot from a high-angle-fire gun would do damage to a submarine, and with a gun of this type it would be almost impossible to hit such a small moving target as the submarine presents. If shells or bombs could be dropped from an aeroplane with great accuracy the submarine would be threatened, but at present the submarine has all the advantages.

Other methods of defence in this warfare are still in the making, but none have proved very effective, and all are of the passive type. They include the floating mine and the drifting net with mines attached. The object of the latter method is to entangle the propellers and hydroplanes, and put the submarine out of action. In the early stages of the war the method of mining was not put in operation for strategic reasons, it being extremely desirable from our point of view to let the Kiel Canal Flotilla come out into the North Sea.

After the lapse of three centuries the submarine has become a formidable weapon. One of the chief deterrents to its development in the early stage was the chivalry that existed between combatants, and a sense or desire for fair fight. The submarine, however, has now come to stay without destroying chivalry.

It is difficult to predict the line along which they are likely to develop. Increase in size decreases the difficulties of propulsion, both when running on the surface and when submerged, but it introduces difficulties of another kind. The larger the vessel the greater the quantity of water ballast to be carried, and the greater also the time required to take in the ballast. Suppose, just for an example, that a submarine is floating unballasted on the surface, and that she sights and is sighted by a 30-knot torpedo-boat destroyer at a distance of five sea miles. The submarine commences to take in ballast on sighting the destroyer. In five minutes the destroyer is within effective fighting range of her guns, and if the submarine cannot ballast and submerge in that time she will present a good size target for the guns. A 1,000-ton submarine would have to take in something like 100 tons of water in order to submerge in short time available.

For some time to come we may presume that the submarine will not be able to sacrifice any of her powers of defence from gun fire so well provided by complete immersion in order to obtain greater powers of attack by means of larger guns, and that, therefore, she will not sensibly change in type. The incidents of the present war in which submarines have figured, emphasize the necessity of the fleet possessing a powerful contingent of submarines, not only that we ourselves but all those who love peace with honor may be secure from the oppression of the tyrant.

THE SILENT PRESSURE—ABOARD A DESTROYER.

By S. A. W.

THE darkness was like black velvet save where the waves broke and smothered over her black bows in a welter of snarling white, flinging their strength against the thin, indomitable, ugly shell of her. Now and then the reflection of those creaming surges that crashed aboard and cascaded out of her scuppers sent a wet gleam upon the tarpaulin-covered torpedo tubes. From where the Lieutenant-Commander stood with the bare-footed Petty Officer upon the swaying bridge, both of them deep in oilskins, the three squat funnels with their streaming ribbons of smoke, beaten down upon the after-deck in a choking, acrid gout of coal and petroleum smell, were very faintly visible against the dark sky of before-dawn. The windows of the little chart-room, blanketed and screened, were blind eyes. Not a yellow light gleamed at scuttle or port hole . . . a bolt of black-painted, living metal upon the anvil of the darkened seas, awaiting the hammer of the god of war to shape her to her destiny good or evil, wallowing, splashing and thrusting through the trough of the winter sea.

The rain fell in stinging wet lashes. The wind was a biting knife, blowing, clean and keen, out of the east. Below seven bells jangled faintly. The wind plucked at the sound and dispersed it to nothingness as though it had been invisible smoke. The Lieutenant-Commander raised his rain-wet face and stared eastwards with tired, contracted eyes. He seemed very young and boyish beside the big bearded petty officer who stood at the wheel.

Low down on the horizon, indistinct with distance, the white arm of a search light swept in a vast arc across the sky, paused for a moment, shifting and jerking uneasily, and dropped again. Astern, over the rim of the dark, white-flecked turmoil which the thrilling screw left behind as the after-deck bucked high in air and the streaming funnels swung dizzily, another light flickered answeringly. In the cabin below the wireless apparatus began to crackle. A messenger climbed the bridge, clinging to the swinging vertigo around him with fingers and toes and burly body. The Lieutenant-Commander took the message into the chart-room, letting forth a momentary flash of warm light, and emerged again within a few moments, nodding to the waiting messenger. Then he turned his eyes again a little longingly to the east, from whence dawn comes.

Near the dark, hunched shapes of the four-inch guns, a little cluster of silent men sat in their drenched and glistening oilskins. At almost regular intervals, as the bows nuzzled deep into the breaking seas, a hissing white slop of water came curling around them. They watched it with keen, weary eyes and, when it sucked strongly at them in its backward boil, clung with their gnarled fingers to the gun fittings, neither laughing nor swearing. Only once, when the squat black craft butted her nose into the wall of a white-topped wave that sent a quiver through all her humming vitals, did the man who had clutched at his mate and snatched him out of the wet chaos of sucking water spit an irritable word. Then he turned and looked at the eastern sky with heavy eyes.

A faint grey film lay between sea and sky, spreading and widening and filling slowly with pink. A little wet shimmer of softest light lay upon the grey face of the tumultuous sea, visible only to eyes which had stared at stark darkness for the past four hours. The wind hesitated a moment, veered slightly and played with the yellow-brown petroleum smoke at the drunken, swinging funnels.

Eight bells flung their music into the rough voice of the breaking waters.

The Lieutenant-Commander on the bridge yawned. The men at the guns rose to their feet and stretched themselves. The watch below tumbled up on deck. — G. W. H.

CONTEMPORARY WAR ARTICLES

Embracing Information and Data Drawn from a Variety of Sources Relative to and Arising from the Prosecution of this Many-Sided European War

NAVAL GUNS' EFFECTIVE RANGE.

PERHAPS no subject is so little understood as naval gunnery, the general idea being that the effectiveness of a naval gun depends upon its extreme range. One enquirer asks for the ranges of the 12- inch, 13.5-inch, and 15-inch guns, and adds, "I am asking this question because newspapers of late have quoted the range for 15-inch guns as between 20 and 28 miles."

Suppose this were true, of what use would a 28-mile range be? The problems that face the naval artillerist are entirely different from those with which the military man has to cope. Military guns are used against fixed objects. The gunner knows exactly where the object is, and, with a map, can fix its distance almost to a yard, and so with his high-angled howitzers can drop shells on to that object, although he cannot see it, and a hill may intervene between it and the gun. His task then is a comparatively simple one.

The naval gunner fires at a moving object, so must see it before he opens fire, and that fact limits the effective range of all guns, no matter what their possible range may be. For example, to see a distance of 28 miles at sea, that is, for the horizon to be 28 miles away, one would need to be 600 feet above sea level. Obviously, no ship in existence has masts that height—125 feet above sea level gives us an horizon of 12.84 miles; 100 feet an horizon of 11.49 miles. We may take it that the control station of the average ship is not more than 100 feet above sea leved, and that, therefore, the extreme effective range of her guns is eleven miles and no more.

At Five Miles Distance.

Let us take a ship firing at five miles—roughly, 10,000 yards—(nautical miles), which is the distance it was generally assumed before the war that naval actions would commence. It would take a projectile 12 seconds to travel that distance. If the ship at which the shot was fired were travelling at 20 knots, she would have moved 120 yards in that 12 seconds, which, of course, has to be allowed for when laying the gun. If the ship from which the shot is fired is also travelling at 20 knots or more, that forward movement must also be counteracted on the sights, so that, when the gunner fires, he does not fire at the ship he desires to hit, but at the spot at which he expects that ship to be when his shot reaches it. Unless he can actually see the ship and judge of her speed, he would only throw his projectiles into the sea.

Last year, Mr. Churchill dealt with the 15-inch gun in the House of Commons, and these were his exact words used: "Its power may be measured by that fact that whereas the 13.5-inch gun hurls a projectile of 1,400 lbs., a 15-inch gun fires a projectile of nearly a ton in weight, and can hurl this immense mass of metal ten or twelve miles," which would be from 20,000 to 24,000 yards, and it is probable that the papers have confused the thousands of yards with miles. The real advantage that the 15-inch gun has over a 12-inch, or even 13.5-inch, is that it has a flatter trajectory, which means a tremendous lot in accuracy of shooting. Some time since, Sir Percy Scott dealt with shooting, and said: "In firing at a range of fifteen miles, which is possible, the shot would go to an altitude of 22,500 feet, which, if my geography is correct, is 7,500 feet over the summit of Mont Blanc."

Fall Directly Downward.

Leaving out the question of the different atmospheres passed through, the shell would, in the latter part of its flight, fall almost directly downwards, which very considerably reduces its chance of hitting. The deck of a ship represents a target of, say, 500 feet long by 80 feet wide, tapering off towards each end, and this would be the target that a shot falling from a great height would have to hit. With a flatter trajectory, the target would be increased immeasurably, because the danger zone increases (this really needs a diagram to make it clear).

The 12-inch gun can penetrate any armor in existence at possible naval ranges, and can fire a projectile just as far as a 13.5-inch or 15-inch, further, in fact, so our object in increasing the size of the guns was for neither of those purposes, but because we can make much more accurate shooting with the larger guns, and their destructive power is, of course, immeasurable greater. — Army and Navy.

SPEED VS. GUN FIRE.

THE battle cruiser action of January 24 on the North Sea is still the subject of considerable discussion, says the Liverpool Journal of Commerce, and this is not to be wondered at when the unique character of the engagement in question is taken into account.

A fighting ship is such an exceedingly complex mixture of offensive and defensive material that very naturally there exist a number of different schools of thought, each one convinced that the exact quality for which they stand is inadequately represented in the actual designs evolved by the Admiralty. Consequently any practical experience such as the recent engagement is immediately seized on by each school in order to prove, or to bolster up, some particular point or points in their train of arguments.

Fighting Ships a Compromise.

At the best a fighting ship can only be a compromise. The three main particulars desired are:—Offensive power, defensive qualities and speed. An increase in either means increased weight, apart, of course, from any innovation made possible by improvements in material, workmanship, type of gun, armor, machinery or any such new departure involving a saving of weight. In any particular ship each main item represents a certain percentage of the whole, and if the amount allotted to one portion be increased, the other weights must be correspondingly diminished, and something has to be sacrificed. An extra knot speed, on a given displacement, can only be obtained by reducing the gun power or decreasing the armor protection.

Again, any standard of merit as regards the three main items mentioned cannot be fixed. We cannot, for instance, say that, between certain limits, a ton of offensive material is worth double that weight of armor; nor is it possible to agree as to the point when a knot extra speed is of more value than a pair of guns.

To attempt to draw general conclusions from the results of one particular engagement is obviously a matter of considerable difficulty. For example, some writers argue that if the German vessels had been speedier they would have got away from our ships without loss, while others say that if the enemy's ships had been much slower they could have carried a much heavier armament, and consequently they would have been able to face Admiral Beatty's squadron with every prospect of giving a good account of themselves.

Such general arguments sound very

nice, but the chief thing with which Britain is concerned is the maintenance of a navy capable of safeguarding its island home, and able to effectively look after our Empire trade routes and its great merchant marine.

Speed the Important Feature.

If this war has taught us anything, it is that speed is of paramount importance. We rely for our existence on the British Navy, and the standard of that navy must be maintained. If a potential enemy builds a vessel of 21 knots, carrying ten 15-in. guns, then we must possess a vessel, or vessels, of higher speed and superior gunfire, capable of engaging the enemy or of driving him to port. Exactly the same argument applies to the light cruiser, the torpedo craft and the commerce destroyer. This Empire must have available the superior offensive powers, for the safety of our mercantile marine demands that those superior powers must be more mobile than those of the enemy. From the above arguments it will be readily seen that the speed of our craft is determined not by ourselves, but by the speed of any possible enemy. In every type of war vessel, our ships must excel in speed.

Distribution of Gun Power.

The question of distribution of gun power is another matter altogether. The essential is that we must possess a sufficient preponderance to overcome the foe. Whether we build two comparatively small ships or one large one is, in a sense, immaterial. Certain economies and advantages are incidental to the very large ship; but this is a very debatable matter on which the efficiency of the submarine is likely to have considerable bearing.

Armour Protection.

All the foregoing statements concerning speed and gunfire assume that these qualities are interchanged, the amount of weight devoted to defensive qualities being approximately equal in the contending ships. It is very probable that the present war will teach us more concerning the relative value of armour plating of various thickness and distribution in the ship than about either of the other points mentioned. The importance if superior gunfire has always been too obvious to need emphasizing, and the British Admiralty have always shown a correct appreciation of the value of speed, but on the question of armour protection their policy has not been so consistent. We are now putting all armour theories through the only real test, namely, actual practice, and from this test many valuable lessons should be learnt.

To sum up, we ought to be able to settle on a definite scheme as regards armour protection from the experience gained in this war. This will leave a certain amount to be divided between weight for guns and weight for propelling machinery. The weight of the latter will be determined by the necessity for our vessels to be faster than the corresponding enemy's ships; and we must build sufficient ships of each class to ensure a definite offensive preponderance.

SMALL ARMS OF BELLIGERENTS.

NO two of the European armies now engaged in war are equipped with the same rifle. The French and Austrian forces are using the largest calibre instruments found on the Continent, while the latter, at the sacrifice of velocity, is employing the heaviest bullet. The German rifle attains the greatest muzzle velocity, but this is partly on account of the fact that it uses the lightest projectile shot by any small arm in Europe.

The longest rifle in service belongs to the Russian equipment, while the French have the longest bayonet, a thing which gives their weapon the greatest total length and, therefore, an advantage in charging. The shortest gun is that of the British army, and, with the bayonet added, the instrument is still shorter than those of any countries, except Belgium and Austria. Owing to the small size of the gun, however, it may be handled with ease.

The British Arm.

The Lee-Enfield 303-calibre rifle, firing a cupro-nickel bullet weighing 215 grains, with a muzzle velocity of 2,060 feet a second, and using a propelling charge of 31.5 grains of cordite, is used by both infantry and cavalry of the British. Although experiments have recently been conducted with a sharp-pointed projectile, the round-nose bullet is still being used. The weapon is 3 feet 8½ inches in length and takes a sword bayonet 17.2 inches long, which gives it an aggregate length of 5 feet 1.7 inches. Its magazine capacity is 10 cartridges, which is larger than that of any other gun now being used.

The French Arm.

The French troops carry the Lebel magazine rifle of .315 calibre, which fires a pointed bullet with a boat-shaped tail, made of a copper and zinc composition and weighing 198 grains. The propelling charge is 46.2 grains of nitrocellulose powder and hurls the bullet from the rifle with a velocity of 2,380 feet a second. In length the weapon measures 4 feet 3⅛ inches, and its sword bayonet 20.72 inches, giving it a total length of 5 feet 11.84 inches. Including the bayonet the weight of the gun is 10 pounds 1½ ounces, which is greater than that of the arms carried by any of the other troops. The magazine holds five cartridges.

The Russian Arm.

Russian fighting forces are armed with the "three-line" Nagant .30-calibre rifle, which is 4 feet 3⅞ inches long and uses the old-style triangular bayonet of 17.2 inches in length, giving the piece a total length of 5 feet 9 inches. The ammunition carries a propelling charge of about 49 grains of pyroxiline, which shoot a cupro-nickel shell, round-nosed, weighing 214 grains, at a muzzle velocity of 1,985 feet a second. With its bayonet the gun weighs 9 pounds 11¼ ounces, while its magazine capacity is five cartridges.

The Belgian Arm.

A .301-calibre Mauser rifle, firing a round cupro-nickel shell of 219 grains, with a velocity at the muzzle of 2,034 feet a second, is used by the Belgians. The propelling charge consists of 37 grains of nitrocellulose powder. In length the rifle is 4 feet 2¼ inches and its bayonet 9½ inches, which gives it an aggregate length of 4 feet 11.75 inches.

The German Arm.

Germany has a .311-calibre Mauser rifle, which fires a pointed projectile made of nickel-coated steel, weighing 154.5 grains. It uses a propelling charge of 48.4 grains of nitrocellulose powder and throws the bullet at a muzzle velocity of 2,882 feet a second. In length the rifle is 4 feet 1.4 inches, while the bayonet, 20.61 inches long, gives it an aggregate length of 5 feet 10 inches. It weighs 9 pounds 14 ounces.

The Austrian Arm.

Austria-Hungary equips its troops with the Mannlicher rifle of .315-calibre. This fires a round lubricated steel bullet weighing 244 grains, which is sent from the gun at a velocity of 2,034 feet a second by a propelling charge of 42.44 grains of nitrocellulose powder. The weapon is 4 feet 2 inches in length and has a bayonet 9.5 inches long, which gives it a measurement of 4 feet 11.5 inches in length. The magazine capacity of the gun is five cartridges, the same as that of the German Mauser rifle.

Range Features.

The Russian "three-line" Nagant rifle has a maximum effective range of 2,096 yards. The Belgian, French and German rifles fire 2,187 yards effectively. The Austrian weapon has a range of 2,132 yards, and the Lee-Enfield rifle of the British forces one of 2,100 yards.

MACHINE GUN FEATURES.

THE basic idea of a multiple or rapid fire gun of the class now generally known as machine guns is probably as old as the history of guns themselves. There

is an old Chinese double-barreled gun in existence which, according to the inscription, was made in 1607, each barrel of which is provided with three vent holes so spaced that there is room for a charge of powder and a bullet between each vent. By this arrangement three shots could be rapidly discharged from each barrel, thus constituting a true rapid fire gun.

Since the time of this weapon many devices having the same object have been designed; but the first weapon that proved actually practical was the multi-barreled gun invented in America during the civil war by Dr. Gatling. This gun was operated by hand power, and was capable, in its improved form, of firing over a thousand shots a minute. It may be remarked that the original French mitrailleuse, so often referred to, was never very successful.

The modern machine gun has but a single barrel, and is, in its most improved form, entirely automatic in its action; that is, after the first shot has been fired it will continue to fire at a very rapid rate, all of the necessary operations of loading and firing being worked by either the recoil or by the pressure of the exploding gases within the barrel. While guns of the semi-automatic type have been made in fairly large sizes, the true machine gun is an automatic gun built to take only the regular service rifle cartridge used by the troops; and these guns operate at speeds of from 400 to about 1,000 shots a minute, depending largely on the size of the charge of explosive in the cartridge.

NOTES ON ORDNANCE.

THE action and conditions existing in a modern heavy gun were described graphically some years ago by a president of the French Society of Civil Engineers. In the case of a gun firing, in two minutes seven shells, each weighing 660 lbs., the 3,200 cubic feet of gas produced by 220 lbs. of smokeless powder develops in the gun bore a maximum pressure of nearly 18 tons per square inch and subjects the breech mechanism to a load of 2,600 tons.

Under the action of these gases (lasting 75-10,000ths of a second) the projectile leaves the muzzle with 40,000 foot-tons of energy, and is able to pierce 22 inches of steel two miles away. The gun and the moving parts of its mounting weigh 47 tons and recoil 3 feet in a quarter of a second, their motion being checked by the 200 tons resistance offered by a hydraulic buffer, so that the speed of recoil at no moment exceeds 22 feet per second (15 miles an hour). At the same time, the running-out gear stores energy to return the gun to its firing position in three seconds.

So excellent is the braking and recoil gear on modern field guns that six to twelve rounds or more can be fired without "re-laying" the weapon. Nevertheless, due to variable windage, imperfect balance in shell walls, variable resistance offered by the driving band to the rifling, variations in the force of explosion and varying recoil jump, it is impossible to ensure two rounds hitting exactly the same spot, and the "sheaf of fire" of an 18-pounder quick-firing gun at two miles range is about 85 yards by 5 yards.

Theoretically, a gun barrel should be so long that the gases expand completely by the time the shell leaves the muzzle, but in practice a shorter barrel (25 to 35 calibres in the case of a field gun) is employed for obvious reasons. Smokeless powders, as now invariably used, maintain high pressure behind the shell so long as it is in the barrel and thus impart maximum energy to it. Black powder generates high pressure very quickly, but does not maintain its driving action so well.

Heavy British guns are built on the wire-wound principle, but most other nations use the shrunk-on tubular construction. Forged steel is then used, typical specifications for inner tube, jacket and hoop materials being: Elastic limit, 46,000, 48,000, 53,000 lbs. per square inch; tensile strength, 86,000, 90,000, 93,000 lbs. per square inch; with elongation, 17 per cent., 16 per cent. and 14 per cent. respectively.

It will be noticed that the weakest material is used for the tubes, which are actually exposed to highest stress in working, the explanation of this anomaly being that the highest specification could hardly be met in the heavy forgings required for gun tubes; also, greater elongation values are obtainable in the lower limit steels, and are, of course, desirable in the heavily strained tubes.

A Good Character for Labor.—Arnold Hills, a veteran and respected engineer, writes to the Press as follows:—"After 30 years' experience of men doing the heaviest class of shipbuilding and engineering work, I affirm with confidence that British workmen are not thriftless and drunken—(like all classes they have their black sheep)—but for the most part they are honorable, hardworking and self-respecting men. They can, however, be overworked, and when thus over-tired they are, like other men, subject to a craving for stimulants, which in turn renders them irregular and inefficient. The Sunday rest is not a fad of the fanatic, but the much-needed interval for recuperation of the hard-worked man; let this be remembered, and the lure of strong drink will largely lose its fatal fascination.

MINE LAYERS.

WHEN the present war commenced, practically every country was still in the experimental stage with regard to at least one particular class of war craft, namely, the mine-layer. This state of affairs is, to say the least, rather remarkable, for past experience had shown how necessary these vessels are, and, moreover, the special qualities desired are well known and comparatively easily attained.

The Vessel Features.

A good mine-layer should be a vessel of relatively small displacement, capable of travelling at a high speed, and possessing good manoeuvring qualities. Such a vessel would be necessary for general use, although for the protection of naval bases, and for home defence generally, the slow boat may be serviceable. The displacement should not exceed 2,000 tons, and the speed should be not less than 24 knots. The apparatus for carrying and dropping the mines can be of an exceedingly simple character, rails on the deck running well over the stern being considered quite sufficient.

The history of the French mine-layer shows the various stages of development in this class of vessel. The destroyer as a mine-layer is generally considered inefficient because of the small number of mines carried. This fact led to the mine-laying destroyers in the French fleet being abandoned and transferred to ordinary torpedo work. These vessels were of 330 tons displacement, and carried 30 mines.

We may note in passing that a number of attempts have been made to combine the work of the destroyer and the minelayer, and providing the boats be built with sufficient beam to give them the necessary stability, the number of mines can easily be increased by building boats of larger displacement. A 1,000-ton destroyer could easily be designed to carry about 80 mines.

To return to the French mine-laying service. Two 900-ton vessels—the Cassini and Casabianca—were converted to carry mines, but these 900-ton vessels could only travel at 17 knots, and were consequently pronounced too slow. Similar reproach was applied to the 570-ton vessels, Cerbere and Pluton, of 20 knots.

When war was declared, a new type had been evolved, and the vessels were to be laid down this year, so that in this particular case the mine-layer was still in the elementary stages. Nor is this the exception, for comparatively little attention had been paid by most of the naval powers to what may be called secondary methods of warfare. Numerous cases might be quoted, but at the present time it would be scarcely politic to do so.—Liverpool Journal of Commerce.

Dominion Wreck Commission Investigations

Following the proceedings of a vessel stranding or collision inquiry is fascinating alike to the mariner and landsman. Much food for thought is always available, and in not a few instances it seems well nigh impossible to reconcile our conception of disaster prevention achievement when confronted with a detailed recital of the circumstances which contribute to many marine tragedies.

SS. "A. W. PERRY."

A FORMAL investigation into the causes which led to the stranding and subsequent loss of the passenger steamer A. W. Perry on or near Chebucto Head, Halifax Harbor, June 8, 1915, was held in the Customs House, Halifax, N.S., on Thursday, June 17, 1915, before Captain L. A. Demers, F.R.S.A., F.R.A.S., Dominion Wreck Commissioner, assisted by Captain John Fleming and Captain Daniel Stewart, acting as nautical assessors. Humphrey Mellish, K.C., appeared on behalf of the master.

Master's Evidence.

Captain Alfred Ellis, the first witness examined, stated that he holds a master's certificate—Coasting, No. 1885; that he is sixty-one years of age, and had one accident before whilst temporarily in command of a vessel. He said that the A. W. Perry was a steel, single screw steamer of 957.30 tons net and 1,601.19 tons gross, official number 106075, having triple expansion engines, capable of a speed of thirteen knots.

He was on the bridge from midnight, and had experienced thick weather from the time of leaving Boston. Soundings were taken continually, these being in charge of the boatswain, who simply let out the line but did not apply the tube; with certain deductions the approximate depth was found. He heard two blasts of a horn, and was under the impression it was the lightship, although he had nothing to base himself upon in that assumption, having no nautical books on board which would show that. Assuming that it was the lightship, he shaped a course NW by W and then N, his ship going half speed, covering the ground he estimated, at about five or six miles, although he did not know the exact speed. The scrap log demonstrates the distance shown on the log, and at certain times the approximate depth of the water.

At about 4.45 a.m. feeling slightly in doubt, he slowed his vessel down, and, almost immediately after, put her full speed astern. She, however, touched bottom within a minute or so, still carrying a little headway. The weather at the time was very thick, with a light easterly breeze blowing, although there was no swell. He had not seen any loom of the land nor heard any sea breaking on the beach, nor any echo of his whistle, which was being sounded in accordance with the rules of the road.

On the bridge at the time with him, were the first officer and the look-out. The engines were put full speed astern just previous to and subsequent to the grounding, and, finding she would not float off, a wireless call for assistance was sent, and within ten minutes the SS. Atlantic was alongside and the passengers were put aboard of her. About ten o'clock a salvage vessel came alongside and began to unload the cargo in the forward holds, the crew having been engaged in jettinsoning some empty crates previous to the arrival of this vessel. The proper instructions were issued, although that fact was not elicited from the master's examination, to the engineer, who stated that he was ordered by the master to pump the water out of number two tank, in order that the ship might be lightened; but it was of no avail.

Mate's Evidence.

The mate, Michael Kane, corroborated the master's evidence, stating that he was very careful to see that the soundings were taken every five minutes, and due entry made in the scrap log, which was the only log kept on board pertaining to the navigation of the ship. The official log was lost, having been left in the purser's office.

Second Officer's Evidence.

The second officer, G. A. Smith, who holds a license as master of a tug, claims he had nothing to do with the navigation of the vessel, and could not throw any light on the courses steered during his watch, from 12 midnight to 4 a.m.

Engineers' Evidence.

The first and second engineers produced their scrap log, showing the movements of the vessel's engines prior to and at the time of the grounding, which corroborated the master's statements, while the look-out testified that he heard two blasts blown on a fog horn, and reported same to the master. The quartermaster stated that the ship steered well, and the courses given were properly steered.

Chas. Brister, salvor, testified to the fact that he rendered assistance in salving the cargo; but owing to the peculiar construction of the vessel it was impossible to get close enough at low tide to land a pump in order to relieve the flow of water which began to make in the forward hold shortly after ten o'clock in the forenoon.

Court Finding.

The court, having carefully inquired into this case, finds that the master has certainly neglected to take the ordinary precautions or use sound judgment in the navigation of his vessel, especially in view of the fact that he had encountered thick weather from the time of leaving Boston.

The scrap log shows very great differences to exist, between the measurements of the line on which he based himself to ascertain the depth of water, indicating by the course he followed that he found himself pretty near Pennan Point, and steered south for a distance of five or six miles. In the course of his soundings, numerous as they were, there was no actual indication of the exact depth of the water, the soundings being purely approximate.

In the court's view, Captain Ellis should, upon finding himself in shoal water, as his measurements indicated, immediately have stopped his vessel and adopted the proper means of ascertaining the soundings which were necessary in order to find his position. Moreover, finding himself in the position which appeared very doubtful, he should have stopped his ship and found out the nature of the bottom, by throwing over a hand lead, which he neglected to do.

It does not seem that any observations were taken by solar or lunar methods to ascertain the deviation of the vessel's compass, it apparently being taken for granted that the compass was only an eighth of a point out on certain courses, and in view of this it seems to the court that more care should have been taken by Captain Ellis to see that no iron which might be included in the cargo was stowed where it might have effected the compass. It seems he was in total ignorance of the fact that there was some iron on board. This, to the court, sounds very strange. Captain Ellis does not appear to have realized the grave responsibility which rested on his shoulders, in having the care of the lives of the forty-five passengers and one hundred and thirty members of the crew in his charge, and it is purely providential that no lives were lost, as had the wind been at all boisterous at the time it is extremely difficult to say what might have happened.

In view of the circumstances attending this casualty, and the methods adopted by the master, which cannot be said to be otherwise than extremely negligent and careless, the court suspends the certificate of Captain Alfred Ellis for a period of six months from this date—June 18, 1915, to December 18, 1915, without the option of a lower grade certificate being issued.

The other officers of the vessel are relieved of all responsibility in connection with this accident, as they had nothing to do with the navigation of the ship, their

services being requisitioned by the master, who was in sole charge of the navigation from midnight up to the time of the casualty.

STAFF CAPTAINS FOR NORTHERN NAVIGATION COMPANY.

THE Northern Navigation Co. have adopted a scheme on their boats of the Great Lakes similar to that which the G. T. P. has in force on its through trains. For some time the G. T. P., in addition to the regular conductor on every train, whose duty it is to operate the train, has employed a train agent for the purpose of looking after the comfort and safety of the passengers. As a great many people from the West go East via the lake route at this time of the year, it will be gratifying to learn that a staff captain has been placed on all the boats of the Northern Navigation Line.

While directly under the orders of the captain, the duties of the staff captain will consist of looking after the discipline of the ship, seeing that the crew is properly stationed and thoroughly understands the lifeboat and fire drill, that passengers are treated with courtesy and respect, and their comforts and needs looked after, and that the ship is kept in spick and span order, thereby allowing the captain of the ship to devote his entire time and ability to the safe navigation of the vessel. This will enable the officers to be on the bridge at all times and prevent their attention being distracted from the work of navigating the ship.

PRESERVATION OF IDLE BOILERS.

A PROBLEM which the engineer has to face from time to time, but which is now not so insistent as when freights are so low as to be barely remunerative, is how best to ensure the preservation of boilers when not in active service. It is well known that boilers deteriorate very rapidly when idle if proper precautions are not adopted.

The problem at present appeals, perhaps, more strongly to our friends the enemy than to us, but the question is one which is frequently recurring. There seems to be considerable divergence of practice, as is instanced by some enquiries we have made in connection with the query of a correspondent who desired enlightenment upon the matter. Ashore there is less difficulty than with a marine boiler afloat.

The usual, and, perhaps, the best plan to be followed is to empty and dry the boiler and afterwards place in it trays of burning charcoal or coke, the boiler then being closed and hermetically sealed to prevent air entrance. The combustion of the carbon uses up the oxygen in the air inside the boiler, and thus renders oxidation impossible. On board ship, when there is any risk of the water freezing, and when such risk cannot be eliminated by some heating arrangement or other, the same precautionary measure may be adopted. Even then, however, there is danger of leakage by way of the sea valves; and, of course, if steam is required in any of the other boilers, there is the danger of leakage from steam stop or feed valves. This renders the adoption of a different plant, which is to keep idle boilers afloat full of water which is distinctly alkaline. A small cock at the highest point of the boiler enables any air which may be in the boiler to be driven off when pressure is applied, and if the water can be heated, the expulsion of the undesirable air is, of course, simplified.

Obviously, before the boiler resumes active service it should first be emptied and thoroughly cleansed. Should it be necessary to raise steam in some of the boilers, and the above method is not regarded as suitable, the empty boilers should be kept dry and a temperature ensured, by stoves in the ash-pits or some such means, which should be well above that of the surrounding atmosphere.—The Syren and Shipping.

TO RAISE LEVELS OF ST. LAWRENCE.

WORK has been commenced by the Marine Department, and is well under way at the lower end of Lake St. Peter, looking toward the raising of the water levels in the St. Lawrence. The recommendations of the commission, of which Prof. E. E. Haskell was chairman, and which investigated the matter of water levels between Montreal and Lake St. Peter, will be carried out in their entirety insofar as affects the ship channel itself.

The recommendations of the commission in connection with the depth of water in Montreal harbor itself are to be considered by the Montreal Harbor Commission, and further action is expected to be taken in that regard.

The Department will first carry out that part of the commission's recommendations relating to compensating works to be built near Lake St. Peter to raise water levels. Coincidentally with this work will proceed the dredging of the ship channel to a uniform depth of 35 feet. The dredging to this depth through Lake St. Peter will be finished, it is announced, by the end of this year. The whole work, however, will take several years to complete, as besides the construction of the compensating works to raise the level of the water there are some 50 or more miles of dredging still to be done. The most difficult part of the operations will be dredging at Cap a la Roche, where the channel will have to be deepened through the solid rock.

The compensating works recommended to be built comprise the erection of a dyke opposite Pointe du Lac, to be about 4,800 feet long, the closing of five channels through the group of islands at the head of Lake St. Peter and the construction of a dyke, some 3,500 feet long, between Isle a Bague and Isle Bellegarde. The estimated cost of the work is $487,-341.

SEA POWER.

IT is said that in this present war no fewer than 1,500 British merchant steamers have been requisitioned for Government service. Some are armed auxiliary cruisers; many are transports; many are fuel, ammunition, or provision ships. Some are prison hulks; some are dragging for mines. These merchant ships are playing an indispensable part in the great conflict, and it is not easy to see what the British and their allies would have done but for the fortunate existence of 20,000,000 tons of shipping on the register of the United Kingdom and her colonies.

All that the late Capt Mahan, U.S.N., ever wrote of the importance of "sea power" in war is being vindicated in this momentous struggle. It is "sea power" that is steadily turning the scale of victory. On the land, so far as contending armies are concerned, the outlook is still indecisive and uncertain, but Great Britain and her allies dominate the oceans of the world through the overwhelming strength of the British navy and the vast magnitude of the British mercantile marine. Away from the German coasts, not one regular German naval ship, so far as it known, now remains in active service, and the Imperial flag is carried only by one or two lone, roving merchantmen, "commerce destroyers" whose activities can make no appreciable impression on the three or four thousand British liners and cargo craft regularly employed in international commerce.

If the British and German war and merchant navies had been equally matched in strength and numbers, the sea would now be witnessing an appaling spectacle of battle and destruction. German squadrons would be raiding British food ships, people would be starving in British towns, and a terrific combat for the cutting off of all supplies and materials of industry would be in progress all over the world. As it is, the food ships are reaching British ports with almost no interruption.

Out of 1,500 vessels entering and leaving British waters in a week, only eight

were torpedoed by German submarines. That vaunted "blockade" is virtually ineffective, but the British Government through its command of the sea is beginning to enforce a real blockade of Germany, in its sweeping declaration forbidding any trade in merchandise of German origin, ownership, or destination. The British people are being saved from industrial paralysis and national ruin chiefly by their ships and sailors, without whose supremacy no British army could have been moved to the defence of France and the rescue of Belgium.—The Marine Journal.

SCOTTISH SHIPBUILDING.

THE feature of Clyde shipbuilding continues to be the steadily decreasing amount of mercantile work done, and the utilization of practically all the resources of the yards and engine shops in the production of naval vessels. During May, less mercantile work was done than during April, while not one new contract was reported by any of the Scottish firms. The Clyde launches were practically confined to three steamers, the largest of which was only 3,000 tons. The Clyde total of 5,040 tons is by a long way the smallest on record for the month, while the four months' total of 41 vessels of 119,223 tons is the lowest since 1908, and the second lowest since 1893. On the East Coast of Scotland four fishing vessels were launched during May, making the small total for the country of 13 vessels of 5,620 tons. The yards, of course, continue very busy, but a larger and larger proportion of the men are being put on naval work. How long this will continue depends wholly on the progress made with the war, but meantime mercantile shipbuilding is counting for very little in any of the districts.

Five Months' Work.

The following table shows the work of the five months in all the Scottish areas:

	Clyde		Forth		Tay		Dee	
	Ves.	Tons	Ves.	Tons	Ves.	Tons	Ves.	Tons
Jan.	7	21,295	1	1,740	.	..	1	200
Feb.	10	42,307	1	200	1	2,000	7	900
Mar.	12	43,101	1	211	2	400	4	755
April	3	7,480	2	2,450	.	..	5	1,330
May	9	5,040	.	..	1	90	3	490
	41	119,223	5	4,601	4	2,490	20	3,675

	May Tons.	Five Months Tons.		May Tons.	Five Months Tons.
1915	5,040	119,223	1897	35,226	120,011
1914	40,012	193,997	1896	32,360	166,583
1913	56,886	293,997	1895	52,099	133,533
1912	53,456	252,500	1894	38,480	125,593
1911	93,846	257,386	1893	25,119	94,333
1910	37,521	184,091	1892	20,706	150,289
1909	40,578	139,939	1891	21,477	127,226
1908	11,072	114,826	1890	26,428	149,652
1907	62,246	242,392	1889	34,729	115,197
1906	51,524	211,714	1888	13,670	73,872
1905	54,036	195,116	1887	15,619	69,325
1904	25,877	161,486	1886	14,957	67,121
1903	40,067	159,387	1885	18,157	75,333
1902	57,278	196,803	1884	23,058	111,468
1901	55,252	187,164	1883	35,854	153,217
1900	51,411	162,916	1882	31,437	126,973
1899	52,139	197,650	1881	36,500	121,984
1898	41,787	159,676	1880	16,650	86,450

Canadian Vessel Captains and Chief Engineers

Through the courtesy of the various Steamship Companies, we are enabled to give a list of 1915 season vessels, together with the names of their principal officers.

CANADA ATLANTIC TRANSIT CO., MONTREAL.

Vessel.	Captain.	Chief Engineer.
Arthur Orr	John Simons	D. E. Mance
George N. Orr	H. Jaenke	J. B. Wellman
Kearsage	W. Baxter	A. P. Williams
Newona	W. J. Moles	W. Paus

OTTAWA TRANSPORTATION CO., LTD., OTTAWA.

Vessel.	Captain.	Chief Engineer.
Dolphin	Z. Lavigne	D. Mornaville
Florence	E. Lefebvre	A. Madore
Hall	J. B. Barclay	W. Drury
Ottawan	R. Malette	C. Lilburn
Sir Hector	W. Mainville	N. Belanger
Scotsman	E. Francoeur	N. Lavigne

GREAT LAKES & ST. LAWRENCE TRANSPORTATION CO., CHICAGO.

Vessel.	Captain.	Chief Engineer.
A. D. Davidson	C. Babb	B. Hammond
A. M. Marshall	T. B. Greenway	O. T. Biddle
George C. Howe	F. P. Russell	J. R. Jones
H. G. Dalton	F. C. Hector	C. Crampton
J. S. Keefe	D. Barry	G. Squier
John Crerar	C. Bennett	W. Vollmer
John Lambert	E. Quackenbush	J. Gallarno
Robert Wallace	J. A. Connelly	Ole Larsen
S. N. Parent	F. H. Johnson	R. S. Mott

CAN. TOWING & WRECKING CO., PORT ARTHUR.

Vessel.	Captain.	Chief Engineer.
Home Rule	Wm. Nuttall	W. Faloona
James Whalen	A. Morrison	H. Cross
Minnie W.	R. Nuttall	John Currie
Orcadian	G. Buell	
Roi Tan	W. Garrick	C. Kennedy
Salvor	E. J. Cadotte	A. Vigars
Sarnia	G. Stitt	J. Farquharson
Superior	A. Fader	L. Williams
Viper	A. McDonald	M. Cosgrave

TORONTO FERRY CO., TORONTO.

Vessel.	Captain.	Chief Engineer.
Bluebell	D. J. Enright	J. Urquhart
Clark Bros.	T. W. Bryan	P. Kenney
Island Queen	W. Osborne	H. Dawson
Jasmine	J. Tymon	F. Rutherford
John Hanlan	A. Belrose	J. Thompson
Kathleen	M. Osborne	J. Harrold
Luella	S. McCuaig	T. Whitty
Mayflower	J. Sixsmith	J. Cameron
Primrose	H. Dick	E. S. Berry
Trillium	R. Williams	J. W. Aston

MONTREAL TRANSPORTATION CO., MONTREAL.

Vessel.	Captain.	Chief Engineer.
Advance	J. V. Norris	J. M. Sherman
Bartlett	A. Lepine, Jr.	J. B. Lappen
Brinson	L. Mallan	A. Stillson
D. G. Thomson		G. Henderson
Emerson	W. J. Murphy	J. Lamoureaux
Fairmount	W. Liddell	G. Flemming
Glenmount	H. Peters	R. Knight
Glide	M. Barry	M. Perry
India	C. Beaupre	F. Brian
Kinmount	Jno. Wood	R. Taylor
Mary	T. Lepine	F. St. Germain
Mary P. Hall	A. Lepine	T. Brabant
Northmount	Jas. Sutherland	R. H. Veech
Rosemount	R. Graham	G. Dennison
Simla	C. Coons	R. Simons
Stormount	Jas. Reoch	F. Moyle
Westmount	F. Howell	W. Spencer
Windsor	Jno. Doyle	A. Dunn

CANADA STEAMSHIP LINES, LTD., MONTREAL.

Bay of Quinte and St. Lawrence Passenger Service.

Vessel.	Captain.	Chief Engineer.
Aletha	J. Crawford	J. S. Thurston
Alexandria	W. Bloomfield	G. Boyd
America	C. J. Hinckley	Jas. Gillie
Belleville	Jos. Rinfret	Jno. Kennedy
Boucherville	A. Laviolette	C. Hamel
Cascapedia	Jno. Hearn	Jno. Van Koenig
Caspian	J. J. Jarrell	C. McWilliams
Louis Phillippe	H. Mandeville	H. Noel
Montreal	F. X. LaFrance	N. Beaudoin
Murray Bay		A. Charbonneau
New Island Wanderer	W. C. Hudson	R. A. Bergen
Quebec	L. R. Demers	J. Matte
Ramona	E. M. Charlebois	S. M. Pelow
Rapids Prince	G. Batten	G. M. Hazlett
Rapids Queen	J. P. Stephenson	J. E. Kane
Saguenay	Jos. Simard	A. Godin
Ste. Irenee	W. Gagne	G. Gagnon
St. Lawrence	Jno. Bertrand	B. F. Farrell
Tadousac	Jos. Dugal	M. Latulippe
Thousand Islander	C. H. Kendall	W. M. Willix
Three Rivers	A. Mondor	C. Gendron

CANADA STEAMSHIP LINES, LTD., MONTREAL.
Upper Lakes and Canal Freight Service.

Vessel.	Captain.	Chief Engineer.
A. E. McKinstry	A. E. Stinson	A. E. House
Aberdeen	N. Hudgins	W. Malcolm
Acadian	P. McKay	C. Burton
Bickerdike	H. A. Leany	S. LaRue
C. A. Jaques	T. Johnson	F. Hamelin
Cadillac	T. D. Sullivan	A. S. Hawkins
Canadian	N. McKay	A. McLaren
Calgarian	R. E. Pyette	A. Black
City of Hamilton	O. Patenaude	W. Dungan
City of Ottawa	J. S. Moore	S. Murray
D. A. Gordon	H. J. Aitkens	Jos. Kennedy
Donnacona	W. Blackler	D. McMillan
Doric	R. McIntyre	Jos. Aston
Dundee	R. N. Anderson	J. D. Andrews
Dunelm		A. C. Leitch
Emperor	G. W. Pearson	G. Smith
Empress of Fort William	N. McGlennon	
Empress of Midland	D. Burke	I. J. Boynton
Fairfax	M. Heffernon	C. LaVallee
Fordonian	J. E. Mann	J. M. Kettles
Glenellah		J. H. McHattie
Haddington	R. J. Wilson	C. Leriche
Hamiltonian	A. B. McIntyre	A. E. Kennedy
Kenora	C. R. Albinson	F. Wilson
Martian	J. F. Davis	J. W. McLeod
Midland King	W. Anderson	Jas. McGregor
Midland Prince	Jas. Tyndall	J. A. Pickard
Neepawah	W. W. Allen	J. C. Carr
Renvoyle	A. McLelland	C. Holmes
Rosedale		T. H. Dryburgh
Stadacona	H. J. Page	W. W. Norcross
Strathcona	C. Dineen	Jas. Payne
Tagona		W. Taylor
W. Grant Morden	N. Campbell	R. Chalmers
Wahcondah	Jas. Wilson	W. A. McLaren
Water Lily	D. McVickers	R. Davis
Winona		J. J. Palmer

"PRIMING" OF BOILERS.

THE bete noir of the marine engineer, the despair of the superintendent, and a source of loss to the owner, who realizes how it impairs the steaming power of his ship and reduces the efficiency of her boilers, is, says Syren and Shipping, "priming." In spite of the care which is devoted to boiler design and construction, priming is unpleasantly frequent, and such will doubtless always be the case, for the reason that it may be, and, in fact, is, frequently due to the shortcomings of the "human element."

The causes of priming may be due to the design of the boiler, which does not provide for the proper circulation of water, absence of local ebullition, and free escape of steam. In such instances of faulty design, water passes from the boilers to the engines with the steam, and unless proper precautions are taken may lead to cracked cylinders or damaged pistons. Of course, the case for the shipowner and his superintendent engineer is that bad management is the cause of priming, and in the majority of instances this is true, provided that the boiler and its steam connections are of proper design for the work they have to perform.

Lack of care, however, must be held the causative factor in many bad cases of priming. Starting the engines or increasing speed too suddenly is one prolific cause. This lessens the steam pressure, with the result that violent ebullition, and perhaps priming follows. Too much water in the boiler is another cause, and more potent still is uneven firing or unequal forcing of different boilers. Impurities in the water, such as mud or oil, which tend to form a layer at the water level, and so interfere with the free passage of the steam generated, also produce priming. Every engineer knows how to deal with the evil when it announces itself, as it usually does by the agitation of the water in the boiler gauge glasses and its alternating level. Even slight priming causes the speed of the main and other engines to be reduced.

It is somewhat of a reflection upon engineering practice that more attention is bestowed upon how to deal with priming when it occurs than upon preventing it. The clever engineer is not the man who copes successfully with priming when it forces itself upon his attention, but he who runs his engines without experiencing the handful of trouble which he may bring upon himself by his own mismanagement or his lack of proper supervision of the work of his subordinates.

GREAT LAKES FISHERIES REGULATIONS.

EXTENSIVE preparations have just been completed by the Provincial Department of Fisheries for the regulation of fishing and the observance of the law along shores of the Great Lakes. The department has chartered the steamer Lasalle for patrol work on Lake Erie. Its duties will commence immediately, and the vessel will be commanded by Captain S. E. Corson.

At the beginning of the present season the Act was changed so that gill net fishers were not required to fish only immediately in front of the district to which they belong. The change provided, however, that west of Port Stanley they must conduct their fishing operations at least ten miles out from the shore, and east of Port Stanley five miles out from the shore.

Complaints have been received from pound net fishermen that the gill net men have been fishing within this stipulated limit. As a result the Lasalle is commissioned to keep order and enforce the law. The steamer also has instructions to seize the nets of United States poachers operating in Canadian waters.

The Athene, with Captain Fleming in command, will patrol the eastern end of Lake Ontario and the St. Lawrence. The Athene was formerly a patrol boat at the Windsor station. She has been replaced at this point by a smaller boat, which, however, is sufficiently speedy to do the work at the west end of Lake Erie, on Lake St. Clair and the St. Clair River.

The steamer Thyra has been acquired for duty in the Thunder Bay waters, and will patrol from Otter Head Point to the international boundary, including Nipigon Bay. Captain Joseph Brown, formerly of Athene, is appointed to command.

MAKING THE MONEY FLY.

IT is too much, perhaps, to hope that any war could be conducted without wasteful extravagance, but the ways of some of our Government departments are just about the limit. A London man, who has had some experience of Government contracts, tells how his company recently had a vessel taken over by the Government at $1,000 a day for hire. It lay idle for three weeks after the contract was signed, then the interior was gutted and rebuilt for troops' accommodation. When all that had been done, it was discovered that the vessel was unsuitable. By that time it had cost the nation $150,000.

Another company had a couple of old ships, no longer in commission, and of so little consequence that they did not even appear in the company's balance sheet. The Government bought them to use as harbor barrage, and the price paid for them was actually more than the original cost! The record transaction concerns a very famous liner which was taken over at the beginning of the war. Men were set to work with pickaxes and crowbars to hew out her magnificent fittings, and after the job had been done with commendable thoroughness it was discovered that the vessel was too big, and she was returned to the owners. It is going to cost the nation about $1,250,000 to repair damage, and a colossal hire bill to meet in addition.

Ferrysburg, Mich.—The steel tug, J. C. Stewart, which has been under construction here for the Canadian-Stewart Co. of Toronto, was launched successfully on June 24. Five-year-old Elizabeth Stewart Plankinton, of Milwaukee, granddaughter of the president of the company, was the tug's sponsor, breaking wine over the prow as she left the ways. The tug is 42 feet in length, 20 feet beam and ten feet in depth. She will be used for towing barges in connection with waterfront development at Toronto.

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RECRUITING OUR MECHANICS FOR BRITAIN.

COINCIDENT with the development of shrapnel and high explosive shell manufacture here in Canada, and arising also out of organized concentration in the Motherland to produce an output of these and other equally effective mechanisms, contrivances and engines of war to supply in full measure the most exacting requirements of our soldiers and sailors and their allied comrades, there has arisen a somewhat natural demand for skilled mechanics.

Figuratively speaking, the fiery cross is ablaze throughout the length and breadth of the British Isles and this Dominion of ours calling for enlistment to the ammunition supply column, and as a consequence, men with engineering experience have little difficulty in finding employment, although due to the scope of the offerings they are perhaps relatively unsettled in determining what for them will ultimately have been the wisest course of action.

A mechanic and a soldier are synonymous terms these days, each being the complement of the other, and at no time in the world's history has this particular fact been given such forceful expression or has its importance been so vividly portrayed. While it is something for all of us to be alive, so far, in this stirring time, and more so perhaps to be of such an age and sufficiently patriotic as to step out of our chosen routine and take the King's shilling, it is equally something to have acquired a trade and such a trade as will help to furnish the weapons and missiles with which our Empire soldiers and sailors may crush the enemy's bombast, rapine and tyranny.

Just at the moment a rather interesting development is apparent in Canada relative to the recruiting and enlistment of mechanics for service in the production of munitions of war in the Old Country, and what surprises us in connection therewith is the easy equanimity with which our Government authorities take cognizance of the situation. They appear to be more or less flattered that an Official British Mission of Inquiry concerning armament labor is now in our midst with the avowed intention of securing machinists, including fitters, turners, millers, millwrights, etc.; riveters, drillers, shipwrights, including ship carpenters; boilermakers and boilermakers' helpers, sheet iron workers, coppersmiths, blacksmiths and blacksmiths' helpers, moulders, etc.

Although several score of our operators have already been shipped to Britain and many times more are in process thitherward, our Departments of Labor and of Trade and Commerce do not apparently realize that the production of shells and other munitions of war is equally important here as in England, and that the work can be equally as well and as expeditiously performed. Besides, isn't it well that Canadian industrial enterprise be fostered and encouraged?

Our manufacturers, particularly those engaged in the production of shells, have not had nor are likely to have for some time to come, anything in the nature of a picnic in the planning and prosecution of the work entrusted to them. Difficulties have had to be met and overcome in the rearrangement of their peace-time equipment, in the securing of prompt delivery of additional machine tools, and in maintaining steady, continuous employment for their operators because of, at one time, a lack of shell steel bars, and of shell forgings. Depletion of the labor market by allowing our skilled mechanics to go to Britain will perhaps more than all the foregoing, hit our engineering and metal working plant managements hardest.

We quite realize, that meantime neither our Government nor any Department of it may interfere with the liberty of our mechanics to choose for themselves what they shall do or where they shall go. We have neither got to the stage of martial law nor any other law which may make of us unwilling accessories, but we have reached the point at which a clear declaration should be forthcoming of the absolutely certain, and, as well, almost certain, war business which our craftsmen will not only get the opportunity to produce but will have to do so right here in at least the near future months, or, for that matter, while the war lasts.

Marine News From Every Source

Kingston, Ont.—The steamer Turbinia is in drydock, and will undergo repairs before leaving for trade on the coast.

Quebec, Que.—The Department of Public Works, Ottawa, contemplate improving the St. Lawrence dock frontage of the Transcontinental Railway at an estimated cost of $500,000. Secretary, R. C. Desrochers, Ottawa.

Vancouver, B.C.—It is announced that the firm of Marsh, Hutton and Powers, contractors, of Port Arthur, Ont., have secured a $400,000 contract in British Columbia. The work is for the main channel jetty on the Fraser river at Richmond, and will employ a large force of men.

Ottawa, Ont.—Tenders will be received up to July 1, 1915, for the manufacture, supply and erection of a 30-ton steam wharf crane, of the derricking jib type, for Halifax, N.S., dockyard. The specifications and conditions of contract may be seen at the office of the consulting naval engineer, Ottawa.

Quebec, Que.—Seven tenders have been received for the construction of the storage dam at La Loutre, on the St. Maurice River, for the Quebec Streams Commission. The dam will be over 1,000 feet long, and over 85 feet high at the deepest part. The area to be flooded will constitute one of the greatest reservoirs in America.

Princess Royal in Commission.—The C. P. steamer Princess Royal, Capt. Locke, which for the past five months has been out of service in consequence of the accident which befell her in Sabine Channel, has been called into commission again and is now being run on the night service between Victoria and Vancouver.

St. Catharines, Ont.—William Riley, of this city, has commenced work on sub-contracts for pile driving on sections 1 and 3 of the Welland Ship Canal. John Morley has also started his subcontract for drilling in the harbor at Port Weller. It is expected that the work will take nearly four years to complete. A quantity of excavation is also to be handled.

Collingwood, Ont. — The Canadian steamer Valcartier, which was sank near Sarnia in collision with the United States steamer Osborne, and upon being raised was brought here for repairs, came out of the dry dock on June 19. Extensive repairs were made, fifteen plates and a number of frames having to be replaced.

The Canadian Pacific Railway Co. has been appointed by the Russian Government as agent in Canada and the United States of the Russian Volunteer Fleet, which is to run steamers between Vladivostock and Vancouver. The C. P. R. will handle all freight intended for Russia by this line through its railway and steamship departments.

A Lake Record.—The steamer Yorkton (Capt. Alexander) of the Mathews Line, trading from Port Colborne to Montreal recently, made a record trip for a full canal-sized steamer. She left Montreal on her last voyage up and landed in Port Colborne in just 54 hours. Considering the detention in the Welland Canal by a congestion of boats passing through, this is considered by marine men to be a remarkably quick trip.

Fordonian Breaks Crank Shaft.—The steamer Fordonian, of the Canadian Steamship Lines, the only vessel on the Great Lakes of her size having Diesel engines, broke her crank shaft above above White Fish Point on June 17, just after finishing a trip across Lake Superior. She was picked up by the tug Schencke, of Sault Ste. Marie, and towed to Port Huron. She will probably be taken to Port Colborne for repairs.

Collingwood, Ont.—On the afternoon of June 19, at the yards of the Collingwood Shipbuilding Co., without any formalities, a steel steam hopper barge was successfully launched. The vessel has been built to the order of the Department of Public Works, Ottawa, and will be used on the St. Lawrence River. The dimensions are: Length 187 feet, beam 32 feet, and depth 14½ feet. There are six hoppers with an aggregate capacity of 530 cubic yards. The barge is self-propelled, and is equipped with powerful machinery.

St. John's, Nfld.—The steamship Neptune has been chartered by a New York moving picture concern to make a trip round the world on their behalf. The voyage is expected to last two years. This vessel is amongst the oldest of the wooden members of the sealing fleet, and in her day was very successful, to her credit being due the landing in one trip of the largest number of seals recorded in history. She has also been engaged in a North Pole expedition, as a supply ship.

Halifax, N.S.—The stranded Plant Liner A. W. Perry, which went ashore near Chebucto Head on June 8 while on a voyage from Boston to Halifax, slipped off the rock upon which it had been resting and sank in six fathoms of water the following afternoon. Captain Ellis and the crew of the ship, who remained on board after the passengers had been removed, to superintend the attempts to take the ship off, had only left five minutes previous to her disappearance.

Wheat Through Lachine Canal.—Since the opening of navigation a little over twelve million bushels of wheat has reached Montreal through the Lachine Canal. This is over 1,500,000 bushels less than it was for the same time a year ago. Twenty-six vessels have brought grain, largely wheat, from United States ports, mostly from Duluth and Chicago. During the last month only four American grain carriers have arrived, but there were twenty-two in the early days of the season.

Ottawa, Ont. — Alex. Johnston, Deputy Minister, and Col. Anderson, chief engineer of the Department of Marine and Fisheries, have returned from a trip of inspection to the Pacific Coast. They say that while trade is quiet at present, the development of ports and the construction of railways now in progress in British Columbia is preparing the way for larger business which is expected to develop after the war. The marine officials state that the G. T. P. dry dock at Prince Rupert, the largest north of San Francisco, which is about completed, will be of material asistance in the development of the Pacific Coast trade.

C. G. S. Montmagny Action. — The Canadian Government has agreed to settle the action it brought against the steamer Lingan for $400,000 in conjunction with the sinking of the C. G. S. Montmagny, below Quebec, on Sept 8, 1914. The Montmagny was rammed by the Lingan, a collier, and sank, several of her crew and passengers being drowned. It is understood the Government has accepted one hundred thousand dollars. The action was to have been tried in the Admiralty division of the Exchequer Court.

Owen Sound, Ont.—On June 13, as a thunderstorm was passing over the town, the wooden structure at the top of the steel tower of the inner range light at the harbor was discovered to be in flames, and in less than an hour it was totally destroyed. The fire is attributed to spontaneous combustion or to lightning. The efforts of the firemen were concentrated on saving the C. P. R. wharves, which are alongside. This is the second time the inner range light has been destroyed. It went up in flames when the C. P. R. elevators were burned in 1911.

Ottawa, Ont.—Announcement of the suspension of the big works at Courtenay Bay is confirmed by the Public Works Department, the contract of the Norton Griffiths Co. having been cancelled. It is stated that the works, entailing an expenditure of about $7,000,000, were to have been completed in two years, but at the rate of progress it appears likely to take 10 years. The company was notified to speed up, and it failed to do so. The works will not be abandoned, but it has not been decided whether the Government will complete it or call new tenders.

Montreal Vessel Torpedoed by Submarine. — The steamer Morwenna of Montreal was torpedoed, shelled and sunk by a German submarine at midday of Wednesday, May 26, at a point 160 miles west by south of St. Anne's Head. One member of the crew of the vessel was killed, while three others were injured. The survivors were landed at Cardiff, Wales. The Morwenna was bound from Cardiff for Sydney, Cape Breton, in ballast. The Belgian trawler Jacqueline picked up the crew. The Morwenna was a steel steamer of 1,414 tons gross, owned by the St. Lawrence Shipping Co., and under British registry from the port of Montreal. She was built in 1904 at Dundee, Scotland.

British Merchant-Ship Building.—The diminution in the amount of merchant ship work actually proceeding in British shipbuilding yards continues, and indeed a stage has now been reached when it is hardly an exaggeration to say that the construction of mercantile vessels has almost ceased there, notwithstanding the obvious need, referred to recently by the Chancellor of the Exchequer, of maintaining the mercantile fleet for the purpose of carrying overseas the national supplies of foodstuffs and raw materials. Naturally, such an extraordinary state of affairs cannot long continue, but at the present moment so pressing is the need for all energies to be concentrated on the building and completion of war and subsidiary vessels for the Government, the claims of all other classes of work in the shipyards are receiving but scant attention.

New Dock Opening.—In the presence of nearly 2,000 persons, among them three hundred members of the Board of Trade, the new Government dock at the foot of Church street, Windsor, Ont., the construction of which was commenced last year, was formally placed in service on May 27. It was expected that Hon. Mr. Hazen, Minister of Marine and Fisheries, would have been present to officiate at the ceremonies, but owing to illness he was unable to come, and Oliver J. Wilcox, M.P., took his place. At the luncheon served under the auspices of the Board of Trade, addresses were made by Mr. Wilcox, W. C. Kennedy; Dr. J. O. Reaume, Collector of Customs; Dr. J. A. Smith, and others. The new dock,which is the best appointed along the Detroit River, cost $65,000, and was built entirely under the supervision of Lieut.-Col. H. J. Lamb of the Public Works Department. It is of concrete throughout, is 655 feet in length and can accommodate the largest boats on the Great Lakes. Upon it is erected a large warehouse of fireproof construction, 300 feet long, with offices for the officials. The river has been dredged to give twenty feet of water at the dock. Jas. A. Reid has been appointed as custodian of the dock and he will assume his duties at once.

GOVERNMENT WORKS WILL BE CONTINUED.

IN connection with the request of the delegation of Canadian Mayors that measures be taken by the Dominion Government to relieve unemployment, it is announced that the Government will continue the construction of all public works under contract in Canada. The total expenditure of the Dominion for the year, apart from the war, will reach $200,000,000, while the war expenditure will make $100,000,000 additional. The Federal Government is, therefore, raising about $1,000,000 per day, exclusive of Sundays, to maintain its existing programme and carry on the war.

In addition to outlays in other departments, the Government programme for the current year includes expenditure upon public works of over $25,000,000, on railways and canals of $27,000,000, on capital account alone and on works of Harbor Commissioners of over $3,500,000.

Since the outbreak of the war, the Dominion has used every effort not only to prosecute the war, but to minimize unemployment in Canada by maintaining its programme of public works, including the I.C.R. terminals at Halifax, Welland Canals, Quebec Bridge, N.T.R. and Hudson Bay Railroads, terminal elevators and harbors at Halifax, St. John, Quebec, Montreal, Toronto, Hamilton, Port Arthur and Fort William, Vancouver and Victoria.

PACIFIC COAST LIGHTHOUSE SERVICE.

WITH the return of the lighthouse tenderder Quadra, the new system of lighting the British Columbia coastline will be complete and in operation. Despite strenuous opposition from coasting mariners, the Marine Department has carried out its plan of having red lights to starboard and white lights to port when northbound. The department has given way in several instances to the demands of the seamen and will have the lights on the Sandheads, Gulf of Georgia; Vancouver Rocks, Milbank Sound; White Rocks, Banks Island, and Hidgson Rocks, Chatham Sound, changed from red to their original color, white.

Early in the year the heads of the Marine Department took a notion to establish a system of lights throughout Canadian waters. This system, while it might be efficient in some waters, is really a step backward in the lighting of British Columbia waters. In the past, the majority of the gas-lighted beacons on this coast have shown white lights. Under the new system nearly twenty lights will show red. A red light can only be seen approximately two-thirds the distance of a white light, and the lightest mist reduces its visibility almost to nil. Yet in face of these facts and the most reasonable objections of mariners, the Department has seen fit to carry out its plan.

Changes Will Help.

The four changes which the Department is making will help to a certain extent, but it took a long time to get consent to the alterations. The Sandheads, Vancouver Rocks, White Rocks and Hodgson Rocks lights are all important to coastwise navigation. Showing red they were practically useless, but when white they may be seen in clear weather for a distance of ten miles. There are several other lights which would do with a change, but the so-called system must be maintained.

CANADA STEAMSHIP LINES.

SINCE the spring movement of grain From the head of the lakes, Canada Steamships have been increasing the number of boats in the outside service, and it is reported that there are now about twenty-five operating in the Gulf of St. Lawrence and the Atlantic, the majority of which are under charter until such time as they will be required for the fall movement of grain. Recently three more boats have safely arrived at British ports with valuable cargoes.

Not only is it hoped to operate these boats to advantage in the outside service this summer but to make arrangements for putting a number of them in European coatswise service next winter, the profits from such operation being clear gain as against tying the vessels up for the cold months.

The officials of the company continue to regard the prospects with marked optimism as compared with the situation which developed last summer on the outbreak of the war.

MOTOR TUG FOR HUDSON BAY.

THE Hudson Bay Co. are having built at the Polson Iron Works, Ltd., Toronto, a gasoline engine driven tug for service in Hudson Bay and other northern waters. The hull is specially designed to suit the particular service for which the tug will be used. It is constructed with steel framing over which is laid wooden planking. Another feature is the turtle deck made of steel plate over the forward section, while amidships above the deck is a steel plate deck-house for protection against the weather.

The principal dimensions are as follows: Length over all, 36 feet; breadth moulded, 9 ft. 6 in.; depth moulded, 4 ft., and draft, 3 ft. The propelling engine is a "Buffalo" 30 h.p. 2-cylinder gasoline motor. As the tug will frequently be used for lightering purposes, four tow barges are also being built. These barges are of steel frame construction with wooden planking laid over in a similar manner as in the tug. The barges are 48 feet long; 14 feet wide and 4 ft. 11 in. deep. They will be shipped "knocked-down," and re-erected at point of destination.

MONTREAL CUSTOMS RECEIPTS.

FOR the month of May, 1915, the Customs receipts at the Montreal Custom House came within $157,173.02 of equaling the receipts for the same month in 1914. If it had not been for the scarcity of tonnage, which has made it difficult for Canadian merchants to get goods from Great Britain, the receipts for last month would probably have exceeded those of May last year. If the same number of regular liners had been coming to the port as there were last year, it is estimated that they would have been able to carry considerable cargoes, owing to stocks being low in the country.

The total receipts for May were $1,854,980.45, as against $2,012,153.47 in May of last year. For April, the receipts were $1,580,738.38, as against $1,571,255.19. Up to the end of May the receipts in 1915 have been $8,342,419.23, made up as follows:—January, $1,541,064.56; February, $1,680,107.41; March, $1,685,528.43; April, $1,580,738.38; and May, $1,854,980.45.

DAMAGES FOR SINKING TUG.

BY a judgment delivered in Sandwich by Registrar Henry Clay, June 19, the Cadwell Sand & Gravel Co., of Windsor, was awarded $11,300 damages against Jacques & Son, of Detroit, for sinking of the sand barge Hustler by the tug Annie L. Smith in the St. Clair River in 1912.

The Hustler was being towed by the tug Annie Moiles. Two of her crew were drowned as a result of the collision. When the action was taken into court it was alleged that the tug Smith was not carrying proper lights, and judgment was given in favor of the Cadwell Co.

An appeal was entered in the Admiralty Division of the Supreme Court in Toronto, which upheld the judgment of the lower court. A further appeal to the Admiralty Court in Ottawa last year resulted in Judge Hodgins giving judgment for the Cadwell Company, and referring the question of damages to Registrar Clay, who was then Local Master. The Windsor Company claimed $14,500, but this was reduced to $11,300. Costs were assessed against Jacques & Sons.

INSPECTION OF AIDS TO B. C. NAVIGATION.

THE Deputy Minister of Marine and Fisheries, Alexander Johnston, recently returned from a five weeks' trip to the Pacific and an inspection of the port and navigation facilities as far north as Prince Rupert. Mr. Johnston was accompanied by Col. W. H. Anderson, chief engineer of the Department. The Deputy Minister will report to Hon. J. D. Hazen upon the results of his trip, covering three questions of considerable importance to marine interests in British Columbia, the adequacy of existing aids to navigation, pilotage conditions and the operation of power boats in the fishing industry.

The two officials, after a short stay at Prince Rupert, traveled down the coast and inspected the various aids to navigation installed along the channels. The information obtained will be used in dealing with the numerous applications which come regularly to the department for increased facilities in the way of lights, buoys and other markings. A complaint that the Pacific coast pilots were charging exceedingly heavy dues, was investigated, and it is expected that there will be a recommendation for a revision of these dues downward.

A complaint against the operation of gasoline boats by men who are not certificated masters, was also gone into. These boats are now used to a considerable extent in gathering the fish from the fishing fleets and taking the catch to port. It has been decided not to require certificated masters on these boats so long as they are engaged in fishing operations exclusively.

Book Reviews

The Progress of Warship Engineering, by C. de Grave Sells, M.I.C.E., is the title of a reprint from Janes' Fighting Ships, 1914, published by Sampson Low, Marston & Co., London, England. Price 2/6, 60c net. This is a most interesting publication and the accuracy of the information contained in its pages is unquestioned, having in mind the reputation of the author. The opening pages contain a description of the "Demologos," the first warship propelled by steam, and designed by Robert Fulton. The development during succeeding years is not touched upon until the advent of modern machinery, such as water-tube boilers, steam turbines, etc. In this section are described various types of steam turbines for war vessels with sectional views showing the general construction and details. This is followed by a description of several types of water-tube boilers, explaining their development and reasons for certain distinctive features embodied in their construction. Boiler economy and efficiency is next dealt with and includes descriptions of such apparatus as gas analysers, efficiency meters, calorimeters and recording instruments, etc. Considerable space is devoted to fuel oil and to the development of Diesel engines, while similar treatment is accorded air compressors and refrigeration plants. Other subjects dealt with include corrosion of boiler tubes, warship ventilation, ash dischargers, transmitters, etc. The booklet is carefully written and fully illustrated. It is both interesting and instructive, as it explains the progress that has been made during recent years in the propelling machinery and boiler plants of warships.

ASSOCIATION AND PERSONAL

A Monthly Record of Current Association News and of Individuals Who Have Been More or Less Prominent in Marine Circles

James Hueston, of Prescott, Ont., a sailor on board the steamer Rosedale, was found dead in the hold shortly before vessel reached Quebec on May 28.

Capt. E. L. Squire, of the steamer Fernfield, fell overboard and was drowned on the night of June 11 while his ship was near St. Paul's Island, near Montreal.

Alex. Milligan, who for many years sailed several of the big steel grain freighters for the Montreal Transportation Co., died at St. Catharines, Ont., on May 29, aged 57. He retired about six year ago.

Capt. Holmes, who had his master's certificate taken from him on account of his vessel, the Morwenna, coming into collision with a ferry-boat in Halifax harbor some months ago, has had it returned by the Minister of Marine. The Dominion Coal Co., which owned the Morwenna, employed the captain in a minor capacity, and he was on board that steamer when it was torpedoed by a German submarine recently off the coast of Scotland. In view of Capt. Holmes' conduct, the Canadian Minister of Marine has deemed it advisable to hasten the time of giving back to the captain his master's certificate.

James Wallace, for many years chief engineer on the Princess Victoria, C.P.R. Pacific Coast steamship, was acting in the capacity of chief engineer aboard the Princess Irene when that vessel was blown up in Sheerness harbor, England, on May 27. In a cable received by Captain Troup from the British Admiralty, it was stated that Mr. Wallace had been in the accident and that the worst was feared. W. W. Rennie, according to a cable received by his father from the Admiralty, is also said to have been lost in the accident. He was formerly third engineer on Princess Victoria.

EVOLUTION OF THE LIGHTSHIP.—III.*

By C. C. Cook.

IN the concluding paragraph of section II. of this paper, mention was made of the fact that in 1806 the British Parliament empowered the Commissioners of Northern Lighthouses in Scotland to construct a lighthouse on the Bell Rock, a dangerous sunken reef to the north of the entrance to the Firth of Forth. The Act also authorized the collection of dues for lights immediately upon the location of a successful signal at the Rock.

The Lightship "Pharos."

In order to profit by the collection of these dues, the Commissioners decided at once to moor a lightship there. This was the first one on the Scottish coast. The work was entrusted to Robert Stevenson, who, as the engineer of the Commissioners, was to direct the construction of the lighthouse. He purchased in Leith a fishing schooner, captured from the Prussians, fitted it out as a lightship, and gave it the name Pharos. The vessel was 67 ft. in length and 16 ft. beam by 8 ft. depth, and of 82 tons register. The hull was extensively rebuilt, three short masts were erected, sails were provided, and accommodations arranged for crew, lighthouse workmen, and officers.

The lanterns were made in two complete vertical sections, and so screwed together as to encase the mast, along which they were free to slide up or down. Each lantern was then fitted with 10 oil lamps having small silver-plated reflectors. The lamps were "agitable" or upon hinges, so that they could be turned readily for trimming or cleaning. These lanterns, as a whole, were absolutely secure in their position on the mast regardless of the movement of the vessel. They could be readily hoisted, and the light could never be hidden by the supporting mast. Lanterns of this type proved so successful that they were adopted for all lightships, and only in the past few years have they been generally superseded by fixed lanterns at the masthead.

The anchor of the Pharos weighed about one and one-half tons. It was of the

*From a paper read before the Society of Naval Architects and Marine Engineers, New York.

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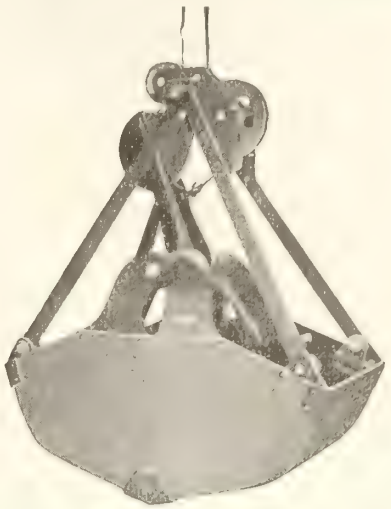

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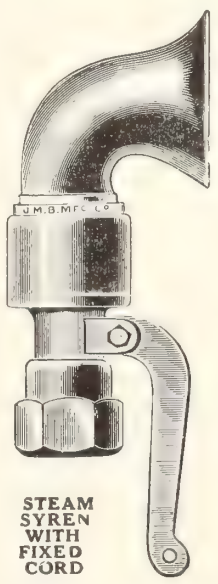

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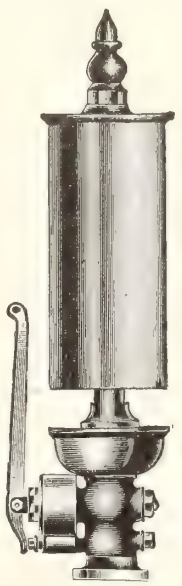

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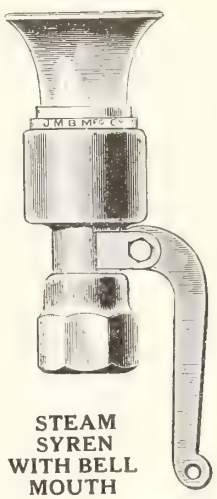

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mushroom type, and, to quote Mr. Stevenson, it resembled "in form, as nearly as may be, the vegetable from which it takes its name." Fifty fathoms of 1½-in. chain and 120 fathoms of hempen cable were supplied; the cable being veered out in unfavorable weather.

The vessel was placed on her station in July, 1807, and after several months' test was duly advertised as an aid to navigation. The lights "when seen from either side have the appearance of a triangle, but if seen end on, they appear as two lights, the one above the other." Thus a distinctive light was obtained. The day signal consisted of a blue flag with a lighthouse in the field, and a bell was tolled as a fog signal.

The full-bodied form of the fishing vessel, the absence of a cargo, the weight of the lanterns aloft, caused the vessel to roll violently. In spite of this the vessel held its station, burned its lights, tolled its bell, and produced revenues until the completion of the lighthouse early in 1811.

The Pharos was another striking demonstration of the efficiency of the lightship. In fact, the Pharos may be considered a developed lightship. After this date improvements came thick and fast, and the history of further development must consist in the general description of typical ships.

The lightship may be considered as made up of the hull, the moorings, the illuminant, the lighting apparatus, the fog signal, and the means of communication with the outside world. The evolution of the hull is made the chief subject of this paper, and it may now be traced to the present status. Before taking up these details, however, we may find it interesting to note how readily other nations followed in the use of the lightship with lanterns and apparatus similar to those on the Pharos.

Lightships in the United States.

In the United States, lightships were first authorized early in the year 1819. At this time Congress made an appropriation for two vessels to be stationed at the Wolf Trap Shoal and Willoughby Spit in lower Chesapeake Bay. The vessel for the latter station received first consideration. As it was the "first object of the kind in the United States," great care seems to have been given all preliminaries. Many persons were called in consultation, and a strange variety of opinions was obtained.

These ultimately resulted in the award of a contract on September 2, 1819, to John Pool, Hampton, Va., for the construction of a vessel to make the "first attempt to establish a floating light." In accordance with the contract it was "to be of 70 tons burthen; copper fastened, and coppered, . . . to be provided with . . . a cabin with at least four berths, . . . and an apartment for cooking; spars, a capstan belfry; a yawl and davits, . . " and so on in considerable detail. Chain moorings were supplied and some 30 tons of ballast carried. There were the usual changes in design and delays in construction, so that the vessel was not stationed until the summer of 1820. It was found to be too small for wholly satisfactory service in the exposed waters of Willoughby Spit, and was moved to a more protected station off Craney Island. A larger vessel was built for the original station.

The idea of the lightship, however, seems to have taken a positive hold upon those in authority, and in 1820 three more were authorized for southern waters. One of these was detailed to replace the first vessel on Willoughby Spit. In 1822 an appropriation was made for the first lightship off New York Harbor, at Sandy Hook. In 1823, $25,000 was made available for the construction of a lightship of not less than 250 tons to be stationed off Cape Hatteras. Thus the most dangerous of American shoals, the Diamond, was first marked, as it is to-day, by the lightship.

Types of Lightship.

Practically all of these vessels were most efficient aids to navigation and fully demonstrated their worth. At one or two extremely exposed and trying stations, moorings were frequently broken, and in 1827 the Diamond Shoal was driven ashore; but the lightvessel continued to grow in favor, and in 1841 there were thirty in service. Notwithstanding the number at this early date, there are but few illustrations or drawings which can be truly associated with a particular vessel of the time. These few, however, give a fair idea of the larger of these vessels, and enable us to understand the report of the master of an early Sandy Hook vessel, that it rolled so as to "heave the glass from the lanterns."

The French Government lighted the Calais Bank with its first lightship in March, 1845. It was of 80 tons, and carried a black day mark 14 metres, and a fixed light 10 metres above the water line. A bell was carried as a fog signal.

A plan of a Trinity House vessel of 1845 is given in Alan Stevenson's "Account of Skeddyvore Lighthouse," London, 1848. It was a vessel with bluff ends and wide flaring sides, and fitted with two bilge keels on each side. The dimensions were 80 ft. in length on the water line, 21 ft. in breadth at the deck, and a burden of 158 tons. The lanterns were octagonal in form, 5 ft. 6 in. in diameter, and fitted with eight Argand lamps in the focus of parabolic reflectors. The moorings consisted of 1½-in. chain cable and a single mushroom anchor of thirty-two hundredweight. The crew numbered eleven men.

Belgium's first lightship was established on the Daedemarkt Bank in 1848. It was fitted with one lantern containing eight lamps having red lights. The lamps were suspended on the cup and ball gimbal principle. The moorings consisted of two anchors, of 17 quintals English weight, with 70 fathoms ground chain, and 120 fathoms chain to the ship from a swivel at the middle of the ground chain. The vessel was also supplied with signals to communicate with the shore, a non-sinkable lifeboat, and carried a crew of eight men. During the first twelve years of its service, the ship remained on the station, except for absences for cleaning and painting, when in 1860 the cable parted in a storm and had to be renewed.

An equally important early French vessel is the Ruytingen, which was stationed in the North Sea off Gavelines. The vessel was 82 ft. length, 21¼ ft. beam, and tonnage of 150. It carried one light at a height of 34½ ft. above the water line on a mast located about amidships, and was moored by two anchors weighing 2,650 pounds each.

Another interesting and valuable record is that of the United States Ligtvessel No. 1. It was the first constructed under the military board, which for many years had direction of the Lighthouse Service, being built in 1855 at Kittery, Maine. The ship began its service on Nantucket Shoal, where its light was the first, and, while its design was to an extent empirical, as was the case of vessels of the time, proved a success in every way. Lying in as exposed a station as held by any lightvessel in the world, it stood the buffeting of the North Atlantic for many years, and is to-day on the important station of Martin's Industry off the shores of South Carolina.

Thereafter new lightships appeared here and there throughout the world, until in 1860 there were approximately 136 in service. Great Britain came first with 48, the United States second with 39, Russia third with 12, then Germany with 8, Denmark and India with 7 each, Australia with 5, France with 3, Belgium and Sweden 2 each, and British America, China, and Turkey, 1 each. These numbers have been further increased from time to time as the needs of navigation demanded and available funds allowed, so that to-day there are approximately 800 lightships scattered generally throughout the world.

It may also be noted that Japan established her first lightship in December, 1868; only 14 years after the visit of Commodore Perry of the U. S. Navy.

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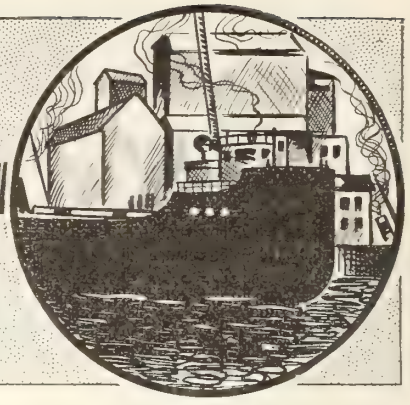

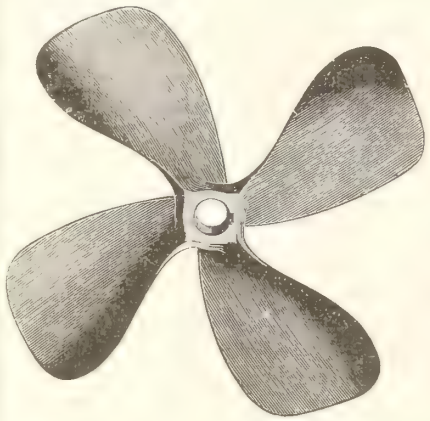

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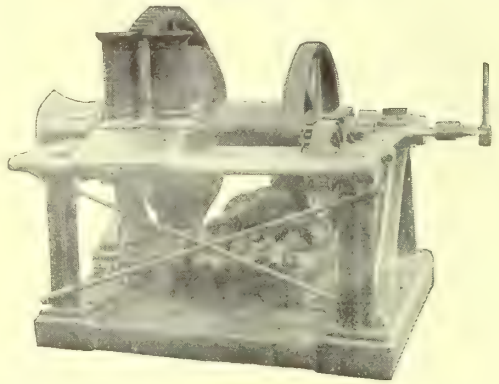

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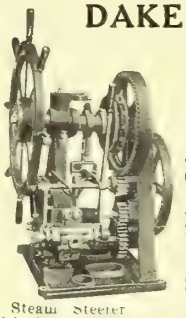

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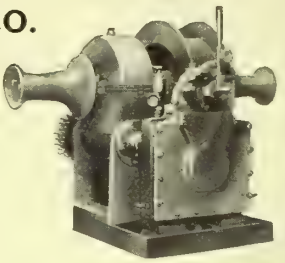

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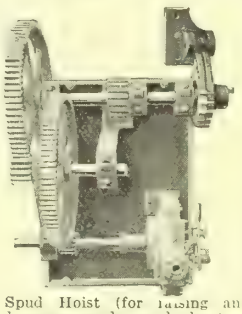

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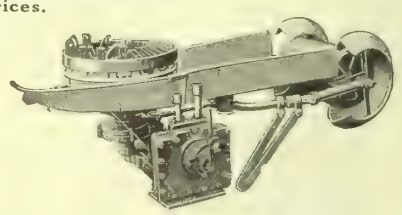

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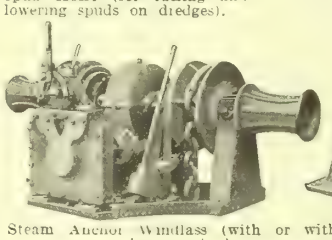

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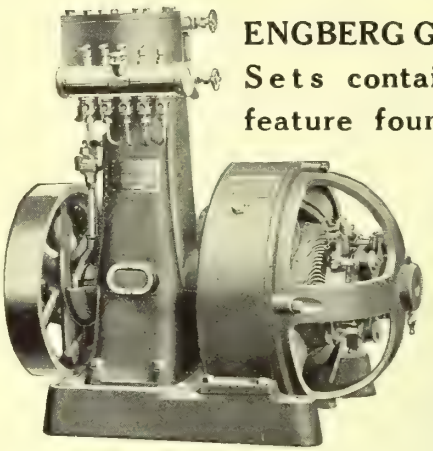

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HIGH EXPLOSIVE SHELL MANUFACTURE

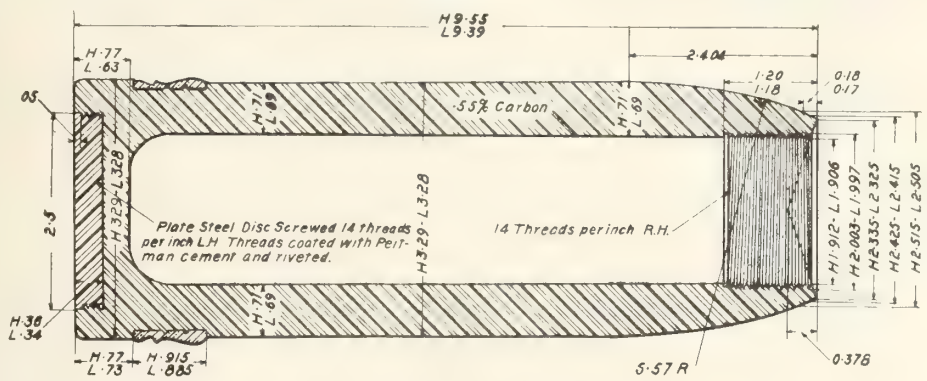
The sudden call from the manufacture of articles of a peaceful commerce to that of supplying the gods of war with provender of a prodigious amount and such as we never dreamed of producing, has been met by the administrations of our iron and steel industries in a manner that demands whole-hearted admiration for their enterprise, capacity, resourcefulness.

THE problems facing machine shops in Canada to-day are perhaps greater than any they have previously had to solve. Even the layman is not very hard pressed to imagine the troubles, difficulties, disappointments, and reverses that beset the inauguration of a new industry. When, however, this industry has to be developed on a large scale against odds that have combined themselves in such a way as to make the successful outcome almost impossible, it is surely a rare tribute to our manufacturers, their executive staffs and the workmen who have put the plans into being, that highly satisfactory results have been and are being attained.

The proposal to make shells for the British guns was placed before the Canadian engineering community with but scant notice. The more daring of our mechanical men, however, jumped at the opportunity to get into this work, being spurred on by two primary motives—first, the patriotic and, secondly, the chance to get their plants running again at full capacity. Canada had been in the throes of a very dull industrial period, and thus, when new equipment came to be ordered, it was found that the machine tool manufacturers had but little to offer from stock, besides being in no way prepared to make good deliveries, because their plants were mostly all working on short time, and could not be put on full time at a moment's notice.

The large number of Canadian shops that went into the shell business fairly swamped the machine tool manufacturers with orders for equipment. Canadian orders were not, however, the only ones upon which the machine tool people were working, because huge orders from the European belligerent powers were also being placed with them. The result was that Canada found herself dependent upon her own resources more or less. Realizing this, our engineers and plant superintendents rose to the occasion and fitted up lathes and various other machines at their disposal to take care of shrapnel shell contracts.

Here, after a period of not longer than twelve months, we find that the difficulties of making shrapnel shells have not only been surmounted, but our organization has been so perfected that a wonderful output is now being obtained. The ingenious methods adopted by our men in attaining this end have excited much admiration on the part of our American cousins, who themselves have earned a considerable reputation for smartness. However, the modesty of the Canadian engineer does not permit him to congratulate himself unduly, and anyway, were he so inclined now, it would be well-nigh impossible, because his shops are going night and day. Any spare time that falls to his lot is usually spent in obtaining a well-earned rest, and he is not much disposed to talk "shop."



Wave same as 18-pound shrapnel. No heat treatment

BRITISH 18-POUNDER HIGH EXPLOSIVE SHELL.

High Explosive Shells.

Lately a new problem has been presented to our machine shops, involving the manufacture of the lyddite or high explosive shell. It must not be thought because the lyddite shell is in some cases of like diameter that it is similar in manufacture to the shrapnel. It is an entirely different proposition, and the purpose of this article is to point out the main differences. There are two sizes of lyddite shells now being manufactured in Canada—the 3.3-in. and the 4.5-in. shell. The former is known as an 18-pounder and the latter as a 35-pounder. These two shells each require a vastly different plant to that for shrapnel, also they are being machined along entirely different lines.

Let us take first the "three-point-

three'' lyddite shell. This finds its way to the machine shops, not as a forging, but as a piece of bar stock cut to rough length. The preliminary operations now in vogue in the various shops are almost identical, but differ from each other in sequence. The order of these operations, however, makes but little difference; therefore one of the most common series will be outlined.

The shell is centred, and is rough-turned the whole length with the exception of that portion upon which a driving dog is placed or a chuck grips it. The bar stock is about 3¾ inches in diameter, and the finished diameter is ''three-point three'' inches, so that nearly a quarter of an inch cut of metal has to be removed from each side of the bar. This metal is taken off and the base of the shell finish faced as far in as the tail centre will allow. The base end of the shell is then finish turned for a short distance, which distance is sufficiently far up to meet the driving band recess. Forming the radius on the corner of the base follows. All of the foregoing is done usually on one lathe.

The next operation is the machining of the driving band groove. Sometimes this operation is accomplished on the same lathe as the rough-turning, and in other cases it is accomplished on another machine. The groove is exactly similar to that on the eighteen-pounder shrapnel.

If this method of taking care of the primary operations has been followed, the next procedure is that of drilling out the shell interior. Rigid drill presses are used almost universally in this process. Sometimes a small drill is used to take a preliminary cut, but in many instances the large roughing drill is put down first.

In some shops drilling out the body is the first operation, the rough-turning being done with the shell mounted on an expanding arbor. When this plan is adopted, another operation is also accomplished, i.e., the machining of the recess in the base. This is possible because the end of the shell is not carried on a tail-stock centre.

The reason for machining a recess in the base is not apparent to the casual observer, the idea, however, being to reinforce the base with a forged base plate. The shell case, it must be remembered, is made from bar stock, and there might be a pipe in the central portion. If this pipe did exist, it might, upon firing, ignite the high explosive charge in the shell before it left the muzzle of the gun, such a result being naturally very disastrous to not only the gun, but the gunners. The base plate is, therefore, a forging, and is screwed in the base recess very securely.

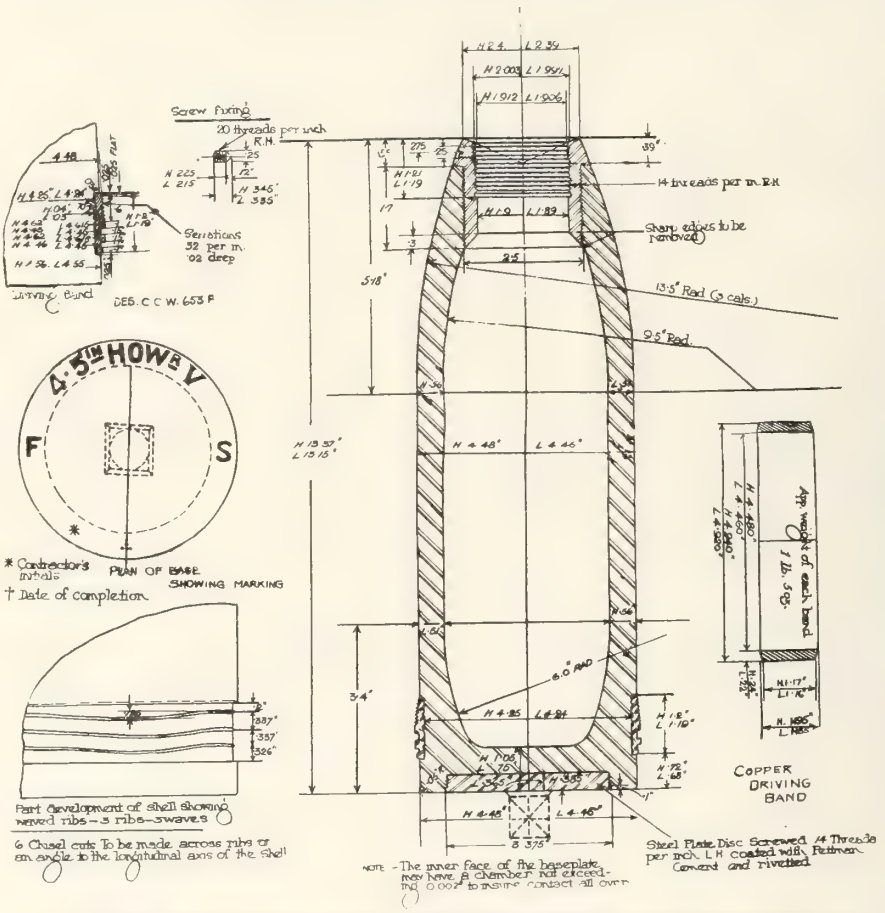
The next operation is the finish boring, the shell being bored the required depth and the bottom of the bore formed. A thread is also cut on the inside of the nose for about a distance of an inch and a half. This thread is cut from a bore the same size as the straight bore, therefore a recess has to be formed to relieve the thread cutter. The specifications call for this, and practice also demands it. This is a right-hand thread cut with fourteen threads to the inch. Taps have not been found to give equal satisfaction on this operation as they have done on the inside of the noses of shrapnel shells. As a consequence, the practice of milling the threads is receiving considerable attention at present, and gives promise of handling the job satisfactorily. Some firms have built small millers for this purpose, and a number of Canadian firms are also putting on the market a line of machines to accomplish this milling.

After being bored and the nose tapped, the shell passes on for the finishing and tapping of the recess in the base. The latter is tapped out for about three threads, and, here again, relief must be provided for the cutter. This base recess thread is left-hand, of fourteen threads to the inch, and is also being milled out rather than tapped. As an extra precaution, however, sizing taps are run down into both the nose and the base, these taps being usually specially made. The shanks are long and round, and pass through a guide bearing which is bored out of the same casting at the same setting as the locating portion of the chuck which clamps the shell solidly for this particular operation. Thus the tap can never get across a thread or spoil a shell.

Rough turning and forming the taper in nose of the shell, when the boring and the tapping of the nose is accomplished, are being featured; but this is, of course, determined by the nature of the tooling placed on the various machines.

The next operation is the finish turning and forming of the shell nose. This is accomplished on engine lathes in like manner to that employed on similar operations on the shrapnel shell. A forming cam is bolted to the back of the lathe and the cross-feed is disconnected. The cross slide has a fixture attached to it which registers against the formed cam, the cross slide being kept always in register by means of springs or by weights suspended from an attached wire rope. All adjustments of the tool are made by means of the compound rest of the machines.

No heat treatment is necessary with this shell. To many manufacturers this will be welcome, as considerable difficulty has been experienced with same in the production of shrapnel. However,


4·5in HOWE V
F
S
PLAN OF BASE SHOWING MARKING
* Contractor's initials
† Date of completion
Screw fixing
20 threads per inch R.H.
Serrations 32 per in. '02 deep
Driving Band
DES. C C W. 653 F
14 threads per in. R.H.
Sharp edges to be removed
13·5" Rad (2 cals.)
9·5" Rad.
8·0" RAD
COPPER DRIVING BAND
App. weight of each band 1 lb. 5 ozs.
Part development of shell showing screwed ribs – 3 ribs – 3 waves
6 Chisel cuts To be made across ribs or an angle to the longitudinal axis of the Shell
Steel Plate Disc Screwed 14 Threads per inch L.H. coated with Portman Cement and riveted
NOTE – The inner face of the baseplate may have a Chamber not exceeding 0.002" to insure contact all over

Q.F. HIGH EXPLOSIVE 4.5 INCH HOWITZER SHELL, MARK V/L/, FORMED FROM STEEL BILLET 4.8 INS. DIA. BY 9½ INS. LONG AND WEIGHING 49 LBS. WEIGHT OF FILLED SHELL 35 LBS. PLUS OR MINUS 9 DRS. WEIGHT OF BURSTING CHARGE (TROTYL), 4 LBS.

another operation is substituted which, to a certain extent, is as great a source of trouble, as far as the loss of time, at least, is concerned. This consists of varnishing the interior bore of the shell and placing the latter in an oven for a period of eight hours, during which period the shell must be kept at an even temperature of 300 degrees F. Various types of furnaces are in use, some of which are electric, others oil, and others gas, etc. As the heat is not excessive, no very great difficulties are experienced in the operation of these furnaces.

The copper driving bands are pressed on in a manner similar to that practised in the 18-pounder shrapnel shell, and the band turning is accomplished likewise.

4.5-in. Shell Production.

The "four-point-five" lyddite shell is received by the shops in the form of a forging and not as bar stock. The preliminary operations consist of cutting off the open end of the forging and rough facing the base end. This forging is heavier than one would imagine, and an especially heavy cutting off machine is required. A heavy lathe fitted with a special chuck very strongly made gives about as good service as any.

The facing of the base is done in two ways. If an expanding arbor be used in the rough-turning operation it is not probably necessary to have a centre in the base end, but, if the rough turning is done with a self-centering chuck, the outer end must be carried in a centre of some description. The outer end is often carried in a tail-stock centre, even if an expanding arbor be used to hold the shell in the case of the rough turning. The base of the shell must thus be faced in a lathe if a centre is to be carried. This operation cannot be performed on a milling machine or boring mill in a jig, as has been the practice with shrapnel shells.

On account of the heavy turning, it is better to work with the outer end carried in a centre to absorb all spring of the tool and fixtures. The rough turning is accomplished on an engine lathe, and it does not seem very practical to attempt same on less than a 26-in. heavy duty machine. The operations here are usually to rough turn the body to within a reasonable working limit for the finish operations. The shell is not always turned the whole length, as the open end may be grasped in a chuck. The base end is usually finish turned up to the metal left on the base in which the centre is carried. This finish operation is, of course, carried far enough to be in that portion of the metal which is later removed when the recess in the base is cut out.

The shell is finish turned up as far as the driving band groove, then the radius of the corner of the base of the shell is formed. The driving band groove can be rough turned and formed here if wished. The tools are carried in a heavy revolving tool holder.

The shell is next bored, a heavy chuck being used for this work, placed on, say, a heavy duty 30-in. lathe. It is not advisable to use a smaller machine. Engine lathes are by far the best to use, a heavy turret being mounted on the cross slide. There should be four bars for boring. A roughing cutter should be put in to bore the straight portion of the bore from the nose inward. It may here be noted that 4.5-in. lyddite shells are bored all the way to the base and finished all over.

A roughing cutter should next be put in to form the bottom of the bore, these being formed cutters with two cutting edges. It helps to have them gashed for chip clearance. The finish cutters should not, of course, have chip clearances provided. The bars should be as rigid as possible, and it is right here, in this boring operation, that the greatest power and rigidity is needed.

After boring, the driving band groove is cut, the groove being considerably wider than the "three-point-three" groove. There are three waved lines in the bottom of the groove, these being formed from a three-point face cam on the face plate of the lathe. Quite as many devices for machining this groove have been developed and operated as have been in the case of the 18-pounder shrapnel and lyddite shells. All the devices, though, are practically a reproduction of the ideas used in the case of the smaller shell tools.

The next operation is that of nosing the shell. It has been found that it is rather expensive to heat the big shell in a lead pot. There is something in the neighborhood of three-quarters of an inch of metal to heat and a great deal of lead is lost by oxidation. Oil furnaces seem to have become popular to accomplish this work, several being now on the market. To nose the shell, various sizes of presses have been recommended. It seems that a press of about 100 tons capacity is necessary, although some makers are advocating a press of 150 tons. Bulldozers and steam hammers have been more or less successfully employed, but just what type of machine will be the most popular is hard to suggest at the moment. However, the man who buys a hydraulic press of 125 tons capacity will not be left very far behind in the work, although there are no doubt many other press specialties that will give quite as good results. It is not considered necessary to even semi-anneal the noses after the bottling-in process, as the metal is so thick that there is not much tendency to chill.

The nosing of the shell is immediately followed by the finish machine operations on the nose. For a distance of an inch and one-half back, the nose is bored straight, then the shell is turned and formed inside. This has to be performed with much greater accuracy than the similar operation on shrapnel shells. The interior curve has to run into the straight bore very smoothly, and not the slightest semblance of a shoulder must be shown. The interior of the shell is later varnished and baked. This varnish or enamel is to keep the explosive lyddite from coming in contact with the steel shell, for when lyddite comes in contact with the steel a chemical action ensues, which destroys the explosive properties of the lyddite. Hence, all shoulders are to be avoided in the inside of the shell, these having a tendency to cause the varnish to flake and expose the steel.

The nose of the shell is finally faced and the outside of it rough turned and formed. To accomplish this, the shell is usually held in a chuck, which grasps it for nearly its whole length, and holds it rigidly. These operations are very similar to those on shrapnel shell. The straight bore of the shell is, however, much deeper than in the case of shrapnel, and this feature makes it rather difficult to tap-thread nose with a collapsible tap. As in the case of the recess in the base, the thread miller is here used to advantage.

In the boring out of the base, the shell is simply grasped in a long chuck and held there securely. Various types of tools are used to accomplish this work, which amounts to a simple recess about three-eights of an inch deep and 3⅜ inches in diameter. The thread is milled in the recess after a relieving groove has been cut.

Next the shell is finish-turned, a collet chuck being generally employed to grasp the shell base, and a threaded centre being screwed into the nose. This centre is supported by the tail spindle. The base of the shell has been finish-turned, as may be remembered, as far up as the driving band recess. A formed cam is attached to the rear of the lathe, and the cross slide disconnected. Weights suspended from wires attached to the cross slide keep the cross slide, which carries the tool, in register with the forming cam, and thus the profile of the nose is turned.

The copper band is next pressed on in machines similar to those used for the smaller lyddite and shrapnel shells. Then the bands are turned. The shell is chucked and a roughing copper band cutter is put into the work. Next a formed finish tool is used.

The base plates are next screwed in place, but first let us make mention of

the machining of these forgings. The back of the disc is faced, leaving the centre about two thousandths higher than the edge, the latter being turned straight. Next the edge is threaded. Machines to accomplish this work at one setting are being designed. The thread is being in many cases milled, followed by sizing dies.

The base plates are screwed home with huge wrenches working on the square shank of the forging. Next the base plate is faced off flush with the base of the shell and peined. The shell is then varnished on its interior, and the varnish is allowed to bake in an oven for eight hours at 300 degrees F. The shell is afterwards removed from the furnace and the brass socket screwed in, the later being afterwards turned. The shell is next chucked and the brass socket formed to a curve, which is a continuation of the curve of the steel nose. When this operation is completed the shell is ready to be painted, after which it is ready for shipment.

UNITED STATES' SHIPBUILDING.

MAINE is full of abandoned shipyards. Probably 25 or 30 may be traced out on the shores of the Kennebec at Portland, but only four or five are still in any way active, and then only spasmodically. The motive of the manufacturer to-day comes from supply; that of the old-time Maine shipbuilder arose from demand.

Timber and Ice.

Maine shipbuilding started from natural conditions. Yankee skippers were born traders. Live oak timber from which vessel frames are made must essentially be grown near water to have the right temper and be cut in the winter before the sap commences running. In the early days Maine had it in plenty, but to-day the cutting has gone back so far from the streams that it is cheaper for Maine builders to get their oak frames from Virginia rather than to haul it out and cut it at home.

Sawmills were at tidewater and timber was floated down the river—sawed, loaded, and transported under highly efficient conditions. The great rivers furnished millions of tons of the best ice obtainable, harvested into houses on the banks, loaded directly into schooners, and carried far south to the West Indies or even half around the world to the South Seas, where it sold at handsome profit. The men who owned the forests and who harvested the ice, or whose schooners caught the fish, built and owned and operated the vessels that distributed their products all over the world.

Now all these conditions have changed. The forests have been cut off so far back from tide-water that there is no more floating of timber down to the sea. The "ice trust" and the evolution of the ice machine killed the ice industry. Artificial refrigeration killed the tropical markets. Therefore another natural incentive for buildings ships in Maine vanished.

Trading Spirit Disappears.

The resulting dulness led to the dispersal of the human factor of the shipbuilding industry. The romance of trading in distant lands also waned in the face of modern commercial methods, as they gradually evolved. The incentive to work up and command a vessel declined as the captain became less and less important. In the old days a captain, charged with not only carrying but selling a cargo and then negotiating for the purchase of a return cargo which could be sold at a profit, was a man of importance. To-day he is merely a functionary, "dangling at the end of a telephone or telegraph wire," to come and go at the beck and call of a manager hundreds of miles away in some big city.

Then came the increased size of carries that proved the value of metal for construction. Building ships of metal is in no way like building them of wood. The plants are different, the workmen are of other trades altogether, the system of operation totally unlike the old. Men who engaged in the new lines of shipbuilding found nothing in Maine to encourage them to locate there. On the contrary, locations along the Delaware or Chesapeake Bay were nearer the base of materials and men. With one or two notable exceptions, modern shipbuilding has grown elsewhere.

To-day modern shipyards usually build vessels on order for transportation companies, and rarely retain an interest in their career once they get their final payment, but in Maine the old system still prevails to a great extent, though some of the live yards build on contract. When asked why he only built on his own initiative, Gardner G. Deering, one of the old veterans of Bath—still in harness, though a near octogenarian—replied:—"I never knew a shipbuilder who worked on contract that had a cent of his own while he was alive or enough to bury him after he was dead. The last time I built a schooner on contracts I offered the owner $1,500 for her as she stood on the ways in my yard, and urged him to take the money, get aut, and leave the vessel to me."

Main Shipbuilding of To-day.

While in general shipbuilding in Maine may be fairly spoken of as a "departed industry," it should not be assumed that there is no Maine shipbuilding. Most decidedly there is, and, in a way, it is flourishing, but it is not of the kind likely to feel the stimulus of a revived mercantile marine under American registry. Talk with the men who know, and they will explain how the big five and six-masted schooners had their day and displaced the small two and three-masters by reason of their large capacity and comparatively small expense of operation, and how, in time, the great bulky barges, of which three, four, or five could be towed by a single tugboat at slight cost, drove out the schooners in the competition for coastwise tonnage. The labor element and that bugbear of American shipping, the Seaman's Union, counted far less in the coal barge than in the schooner. Finally, the great steel steam collier has come into competition with the barge, and is now threatening to displace it to a large extent.

It is said that thirty years ago Bangor owned 250 vessels of possibly 300 or 400 tons capacity. Twenty years ago it had shrunk to a hundred, and to-day it is not more than thirty. Similar conditions might be mentioned of most of the ports of the Maine coast. With the exception of the Bath Iron Works—t truly modern yard, making specialized types of craft, and which will be treated in a latter letter of this series—and the yard of A. and E. Sewall, Maine, does not appear to have engaged, or attempted to engage, in steel shipbuilding. In time the Sewalls quitted the experiment, and to-day the yard is in a state of partial decay; at least not suited for immediate operation. The Kinco was the last vessel built there, and where her keel once closely hugged the ground stands a large apple tree, which has borne prolific crops for several years.

There are now four "live" yards in Bath (excepting, of course, the Bath Iron Works for reasons stated above)—the Kelley-Spear Co. yard and the yards of Percy & Small, Gardner G. Deering, and F. S. Bowker. Of course, there are many small yards where motor boats are constructed and fishing boats repaired, but in the line of constructing larger vessels the records show forcibly the gradual decline n tonnage as well as the changing types of vessels now being constructed.

This year things will be "looking up" somewhat, for every yardmaster in Bath admits a brightening of prospects, and there are now on the ways at the Kelley-Spear yards three large barges aggregating almost 5,000 tons, three vessels at the Bath Iron Works with about 2,600 tons, while Percy & Small and Gardner G. Deering are each about to lay down keels for schooners which will total over 3,000 tons gross, a total to be delivered before the end of the year of eight vessels with tonnage of over 10,000 tons. Besides, there is inquiry for vessels in

(Continued on page 150.)

Principles of Laying—Off Cylindrical Intersections---I.

By J. W. Ross

The more or less special nature of the work involved in the making of sheet metal piping has caused many manufacturers to avoid this class of work, with the result that when a job has to be handled, there is frequently considerable unnecessary loss incurred through errors in laying off material. The examples treated by the writer of this article should form a valuable reference to many manufacturers on ordinary as well as special occasions.

THE perspective drawing in Fig. 1 illustrates the intersection of two cylinders of equal diameter. The method of obtaining the mitre line, which is essential to the development of the patterns, is shown in Fig. 2 and 3.

Construction.

To construct this tee, measure off in Fig. 2, H G equal to 2½ inches. At right angles to this line, make H A and G F

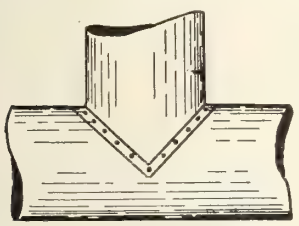


FIG. 1.

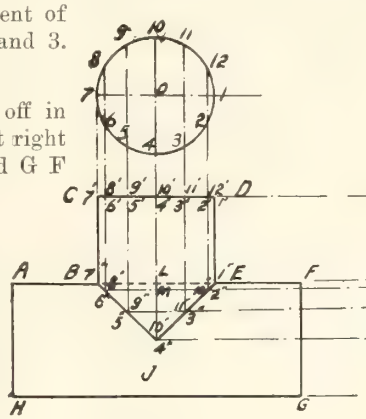


FIG. 2.

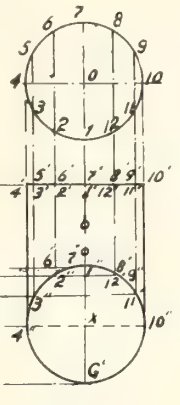


FIG. 3.

equal to the diameter of the cylinder, which is 1 inch. Draw the line A B E F parallel and equal to H G. Measure off A B and E F each equal to ¾ inch, thus locating the diameter B E, of the intersecting pipe, which is equal to one inch. Raise the perpendiculars B C and E D equal to ¾ inch each. Connect C to D, thus completing the elevation view of the "tee" as shown in Fig. 2. To delineate the mitre line, it will be necessary to construct an end elevation view, as shown by Fig. 3.

At a suitable distance from Fig. 2 draw in the centre line G^1 7, Fig. 3, parallel to the line D E, Fig. 2. The points 7^2 G^1, Fig. 3, are located by prolonging the lines A F and H G, Fig 2. With centre X and radius X G^1, Fig. 3, strike the circle 4^2 7^2 10^2 G^2. Draw the line 4^1 10^1, Fig. 3, equal in length, and in line with C D, Fig. 2. Draw the lines 4^1 4^2 and 10^1 10^2, Fig. 3, parallel to the centre line 7^1 G^1. This completes the end elevation view. Project and describe—in a suitable position—the whole plan view, 1 4 7 10, above the cylinder elevation C B E D, Fig. 2. Divide this plan view into a suitable number of equal parts, as shown by the 12 divisions in Fig. 2. From these points draw projection lines —parallel to C B and D E—through the line A F. In Fig. 3 also draw a plan view in its correct relation to the cylinder and divide this into the same number of equal parts as was done in the case of Fig. 2. Project these points—parallel with the centre line 7 G^1—to their intersection of the cylinder 4^2 7^2 10^2 G^2. In Fig. 2 the plan view is numbered from 1 to 12. Similarly the intersecting points of the projection lines are numbered in relation to these numbered points in the plan view. Fig. 3 must also be numbered in relation to Fig. 2. As the view in Fig. 3 is shown by a quarter turn to that of Fig. 2. Therefore 1 as shown in Fig. 2 of the plan view will be shown by 1 on the centre line 7 G^1, Fig. 3. The other points being numbered accordingly and in relation to both Figs. 2 and 3. The intersecting points are also numbered in respect to their positions.

The points 4^2 and 10^2, Fig. 3, are projected over to Fig. 2 by drawing a line parallel to the line H G. Where this projection line 4^2 10^2, Fig. 2, intersects the vertical projection line 4^1 4^2, 10^1 10^2, Fig. 2, this locates the extreme point of the mitre line as shown by the letter J and the numbers 4^2 10^2, Fig. 2. Also by drawing lines parallel to J X project over the points 3^2 5^2 6^2 7^2 etc., from Fig. 3 to their intersection of their similarly numbered vertical projection lines in Fig. 2, thus locating the points 7^2 8^2 6^2 etc., Fig. 2. Connect all these points, thus defining the mitre line. Now having obtained the mitre line, the two intersecting pipes may be developed. The straight line D C D, Fig. 4, is made equal in length to the circumference of the cylinder of which D C, Fig. 2, is the diameter. C D, Fig. 2, equals 1 inch, therefore the stretched-out circumference D C D will equal 1 inch multiplied 3.14 = 3.14 inches, which is slightly over 3⅛ inches.

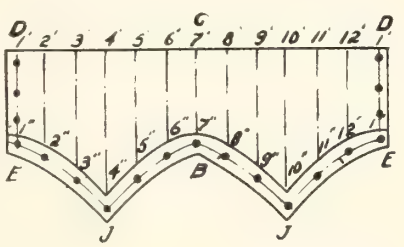


FIG. 4.

Divide D C D, Fig. 4, into the same number of equal parts as in the plan views, Figs. 2 and 3, which is 12. Number these points in consecutive order, with the idea in mind of having the vertical seam to come on the line 1^1 1^2, Figs. 2 and 3. Project lines downward from these points at right angles to D C D, Fig. 4 with the trammels or dividers set at a length equal to 1^1, 1^2, Fig. 3, transfer over to 1^1, 1^2, Fig. 4, this line being the vertical rivet line for this pipe, therefore this distance will be marked off on the extreme division points of the line D C D Fig. 4, as 1^1, 1^2 and 1^1 1^2. Reset the dividers to the distance 2^1 2^2, 6^1 6^2, 8^1 8^2, 12^1 12^2 Fig. 3 which are all equal in this case, and transfer over to their proper positions in Fig. 4.

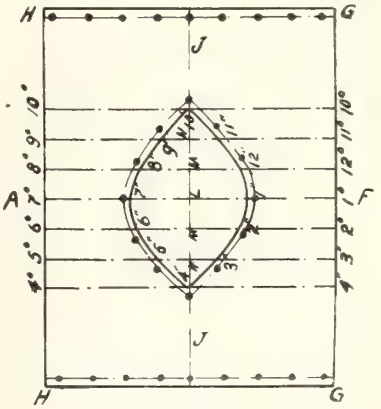


FIG. 5.

Again reset the dividers to the equal distances 3^1 3^2, 5^1 5^2, 9^1 9^2, 11^1 11^2, and similarly transfer these over to their positions in Fig. 4 as denoted by

*Note: The reference letters and numerals in the text, i.e., G^2, 7^2, etc., correspond with those of the illustrations indicated as G", 7", etc

their respective numbers. A fair curve drawn through these located points will denote the mitre line. This mitre line is the flange line for light riveted plate.

The riveted line and laps being afterwards added according to the thickness of the plate and the size of the rivets.

If this tee is made of tin, to be soldered, then the mitre line will be the junction line of the two pipes, soldering allowances to be added as required. Fig. 4 shows the completed templet for a riveted connection. To develop the cylinder H, A, B, E, F, G, Fig. 2 calculate the stretchout of which F G is the diameter. F G equals 1 inch, the stretchout will therefore equal 1×3.14 equal to a little more than $3\frac{1}{8}$ inches.

Measure off G G Fig. 5 equal to $3\frac{1}{8}$ inches. Draw H H parallel and equal to G G and the distance apart H G equal to the length of the pipe which is $2\frac{1}{2}$ inches as measured by the length A F or H G, Fig. 2. As the pipe A F G H, Fig. 2 is a right cylinder, so will the outline H H G G be a perfect rectangle, that is to say its opposite sides being parallel and its angles right angles. This plate may be squared up by the process as explained in an earlier article of this series.

Bisect G G at F, Fig. 5, erect the perpendicular F A. Measure along the curve the distance $7^2\ 6^2$. Fig. 3 transfer this over to $7^0\ 6^0$ Fig. 5. Again take the length $6^2\ 5^2$—along the curve—Fig. 3 and transfer over to Fig. 5 as $6^0\ 5^0$. Also transfer the distance $5^2\ 4^2$ Fig. 3 to $5^0\ 4^0$ Fig. 5. Similarly make the distances $7^0\ 8^0$, $8^0\ 9^0$, $9^0\ 10^0$. Fig. 5 equal, to their distances as denoted by their respective numbers in Fig. 3. Erect perpendiculars from these points to the line H H and number as shown. Bisect H G at J and draw in the line J J, Fig. 5. Set the dividers to the distance $L1^2$, Fig. 2 and transfer over to $L1^2$ Fig. 5. Reset the dividers to $M2^2$ Fig. 2 and again transfer to Fig. 5 as $M2^2$. Make $N3^2$ Fig. 5 equal to $N3^2$ Fig. 2. Similarly transfer over the remaining distances in Fig. 2 to their corresponding numbers in Fig. 3. An even curve drawn through these located points, will define the mitre line or the opening in this pipe. The rivet lines and hole centers are drawn in according to requirements. Fig. 4 shows the rivet holes to connect to the corresponding rivet holes in Fig. 5. It is extremely difficult to have these holes come fair, after rolling up and fitting together of the pipes, due to errors of workmanship in flanging and rolling. Generally one or the other is left blank regarding holes. The pieces being fitted together, marked off and then drilled or punched as the case may be according to the facilities of the shop. The general practice for light work is to put the holes in the vertical piece before rolling, then fit it to the horizontal pipe, afterwards drilling the holes through. In heavy work the holes are put in the pipe with the opening also before rolling, and the vertical piece is then fitted on, marked off and then punched. Fig. 5 shows the completed templet for the horizontal pipe shown in the perspective view Fig. 1.

THE ECONOMY OF CONDENSING.

EVERY steam engine rejects its exhaust steam at a pressure somewhat higher than exists in the vessel into which the exhaust is discharged. The condensing engine discharges into a condenser in which the pressure is, let us say, 2 lb. absolute. The cylinder pressure proves to be say, 3 lb. The same engine, without a condenser, discharges into an atmosphere at 14.7 lb. absolute pressure, and it may be assumed that its cylinder pressure will be 15.7 lb. absolute on the exhaust stroke. That is to say, the steam ports and passages give very much the same resistance whether there is a condenser or not; or in other words, whatever the vacuum secured, the mean cylinder pressure will benefit by that amount, for the excess or back pressure will remain very much the same. Thus, an engine will simply gain the advantage of its added "vacuum."

Let it be supposed that a given engine is doing its work at a mean pressure of 35 lb. non-condensing and that the addition of a condenser produces a "vacuum" of 12 lb. The engine will now possess a mean pressure of 47 lb. Let 1 lb. be taken off this for air pump driving and other losses, actual or assumed, and the mean pressure available for work will be 46 lb. instead of 35 lb. For the same steam that did work equal to 35 units, there are now being done 46 units. The unit of work is now done with an economy of 31.4 per cent. Usually, the condenser is not applied in order to do more work, but to save steam. With this in view the addition of a 12-lb. vacuum would enable the mean pressure to be reduced 12 lb. on the original non-condensing diagrams, or if 1 lb. is again allowed for air pump driving, by 11 lb. or to 24 lb. Then $24 + 12 = 36$ lb., the new mean forward pressure. The original non-condensing diagram showed a mean pressure of 35 +, say, 2 lb. + 14.7, or 51.7 absolute. Then the mean absolute pressure when condensing will be 42.7 absolute.

Economy Example.

Now, the mean forward pressure of a steam diagram is

$$P \times \left(\frac{1 + \text{hyp. log. } r}{r}\right),$$

where P = initial pressure and r = ratio of expansion. In one case the quantity in the bracket is $\frac{51.7}{42.7}$ greater than in the other case, or as 1.21 : 1.00.

The quantity in the bracket may be worked out and tabulated for a large number of expansion ratios. For a cut-off at six-tenths, or an expansion of $1.66 = r$, the quantity is 0.907. Assume this to be the case for the high-pressure working. Divide this number by 1.21. Then $0.907 \div 1.21 = 0.75$, which represents the bracket quantity for a cut-off at about three-eighths, or $r = 2.66$. Then the steam consumption ratio is as three-eighths to six-tenths, or as 5 to 8, and the steam economy is as 1.0 to 1.6, or 60 per cent.

This simple calculation shows the great economy that may often be secured by applying condensation methods, but it must not be expected that the actual economy will be so great, for it is well known that the losses which arise from cylinder cooling and heat interchange effects, all work to diminish the economy to be derived from earlier cut-off and greater ratios of expansion. If the best economy were sought it might be found partly in putting the cut-off earlier and partly in reducing the size of the cylinder, but this would depend much upon whether the earlier cut-off necessary was such as to give to R a value too high, whereby too much cylinder condensation would occur. The use of superheat would influence the question, for, by the aid of super-heat, the cut-off in a steam engine may be economically possible at an earlier point than when there is no superheat.

Steam Engine Performance

It is never possible to calculate steam engine performances with mathematical accuracy, and therefore it is useless in rough practical work to confuse the issue by fine-drawn mathematics. Every engine is a law to itself, and two engines cast off the same patterns by the same moulder may be very different performers, for their inner cylinder surfaces may possess quite different textures and qualities. It is however, simple to work out broad features and find what any change should do by way of economy.

In electrical work, where the load varies much, the average mean pressure taken over, say, an hour's run, is very low, and the addition of a 12-lb. vacuum may mean a very large percentage of economy, for the addition of vacuum adds practically a rectangle the full length of the indicator diagram, which, above the atmospheric line, is a figure which curves rapidly down to near that line or even below it.—Power User.

CORRUGATED FURNACES FOR VERTICAL FIRE TUBE BOILERS.

By F. W. Dean, Boston, Mass.

I HAVE been impressed for many years with the value of corrugated furnaces for vertical boilers, but only recently have actually used them. By the use of such furnaces, staybolts are done away with, and as there appear to be no disadvantages in the furnace this is a most important feature. As many hundreds of staybolts are avoided in each boiler there are just so many less opportunities for breakage and needed repairs. In the staybolted firebox it is necessary for safety to drill holes in the ends of the staybolts in order to know when they are broken.

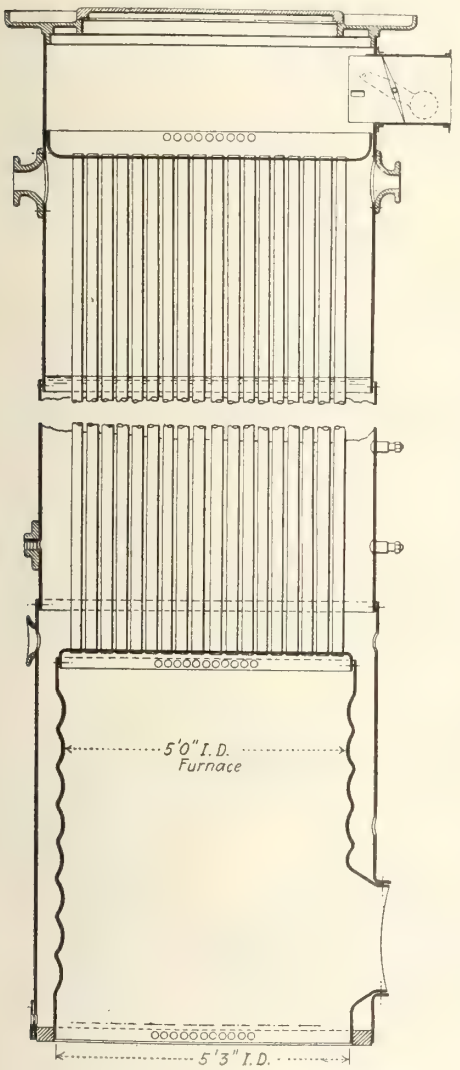


FIG. 1. SIMPLE DESIGN OF VERTICAL BOILER WITH CORRUGATED FURNACE.

The simplicity of vertical boilers with corrugated fireboxes must commend them to owners and makers. In the boiler shop the operations of building are of the simplest and most rapid kind. Again this type of firebox provides for expansion and contraction of the tubes in a safe manner, but on account of its somewhat flexible character it should be assumed that it is advisable to support the lower tube plate as near the edge as practicable. The ordinary firebox is rigid vertically and supports the edge of the lower tube plate, but as the corrugated firebox has slight elasticity it is best to hold up as much of the tube plate as practicable by the tubes and provide little or no elasticity in the tube plates. The flat and unstayed portions of the upper and lower tube plates should be made equal in diameter in order to balance.

The flanging of the fire door presents no difficulty, but it should be done so that the corrugations coalesce with the conical part. The behavior of the firebox end of the boiler when under pressure led to some speculation, for the area of the fire door opening theoretically unbalances it. When under hydrostatic pressure, various gauges were used for showing distortion, but none could be discovered.

In regard to sizes of such furnaces the catalogue of an American maker gives 60 in. as the maximum inside diameter, but, as a matter of fact, this concern can make them up to 72 in. diameter, and almost 1 in. thick. They have been made slightly larger in Germany and the furnace of the larger boiler illustrated was obtained in that country. If the inside diameter is 72 in., the grate will be 3 in. larger or 75 in. and the grate area 30.68 sq. ft. It is easy enough to generate 200 h.p. on a grate of this size with considerable capacity for forcing beyond that, and there is no difficulty in providing the heating surface for such horsepower.

In the matter of pressure, a furnace 72 in. in diameter and 0.95 in. thick will carry 200 lb. If there were sufficient demand for larger furnaces they would probably be forthcoming. The theory of heat transmission through plates, and experience, show that thick furnaces, especially if without riveted joints, are objectionable.

The introduction of corrugated furnaces for the fire boxes of the vertical type of boiler is, I think, a real improvement in steam boilers. The type possesses the important qualities of giving maximum and permanent economy, superheating the steam from 20 deg. to 40 deg., being free from brickwork and requiring small floor space per horsepower.

Fig. 1 shows a boiler of the simplest possible design, two of which have been in use for a year and a half, and Fig. 2 shows one with the interior accessible for inspection and cleaning which has been in use a few months only.

TORONTO HARBOR WORKS TROUBLE.

DIFFICULTIES appear to have arisen in connection with the improvements being made in the eastern part of Toronto harbor, sub-contractors having been ordered to cease work. The operations under water in the east end of the harbor, which will cost in the neighborhood of $5,371,372, are being carried out by contract betwen the Dominion Department of Public Works and the Canadian-Stewart Co. The latter has let sub-contracts for pile-driving to the Herron Bros. Co., and the I. A. Hodge Co.

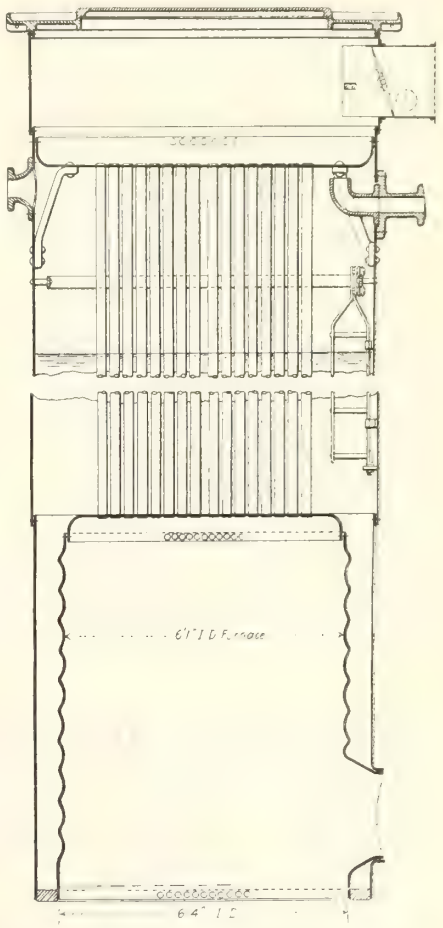


FIG. 2. LARGER BOILER OF THIS DESIGN WITH INTERIOR ACCESSIBLE FOR INSPECTION.

It is rumored that the trouble has arisen as a result of an investigation by a Commission, named by the Dominion Government, consisting of two engineers from Ottawa, one from Winnipeg, one from New Brunswick, and a contractor from Toronto. It was appointed in consequence of allegations that unsatisfactory work had been done by the sub-contractors and it is alleged that after investigation, the commission sent a report to Ottawa criticizing parts of the work, and declaring other parts to be defective, and not in accordance with the requirements of the contract.

CONTEMPORARY WAR ARTICLES

Embracing Information and Data Drawn from a Variety of Sources Relative to and Arising from the Prosecution of this Many-Sided European War

THE SUBMARINE IN WARFARE.

So far as the war has gone, says a correspondent of the Liverpool Journal of Commerce, one type of craft that has proved itself to be more effective than was anticipated is undoubtedly the submarine. It has shown itself to be an almost perfect defence of a coastline against hostile war craft of even the latest and heaviest type. It has proved the most, and, in fact, one might say, the only really formidable weapon against the modern battleship, and has, indeed, rendered it unsafe for large war vessels to patrol the seas. Also leaving aside the question of legality of the new German method of warfare, the submarine has become the strongest possible danger to merchant shipping, thus putting a nation with a relatively weak navy more nearly on a level with a predominant Sea Power.

Starting the war with about 15 submarines of the sea-going, long-range type, and probably never more than 20 at any time, the Germans have been able to sink 12 British war vessels, including three battleships and three large cruisers, and to destroy more than 100 merchant vessels. This, of course, as we know, does not necessarily imply that this latter fact is important from the naval aspect, but it shows us we now have to reckon with the possibility in any future wars of a similar course of action being pursued by one of the warring nations.

Future Naval Design Policy.

No other type of war vessel has done anything approaching the same effective work as the submarine, and from a superficial survey of the whole problem, it might be thought that this has already, once and for all, solved the question of the policy which must be followed in naval design in the future. It might, for instance, be deducted that we, among other nations, must concentrate upon the construction of submarines on an enormous scale, even to the exclusion of building large capital ships. Yet it is obvious, if the matter be carefully considered, that what is undoubtedly the correct policy for one nation would be quite inadvisable in the case of another. In particular a strong naval Power must always keep the offensive most clearly in view, whilst a weak naval Power must necessarily rely upon defensive tactics.

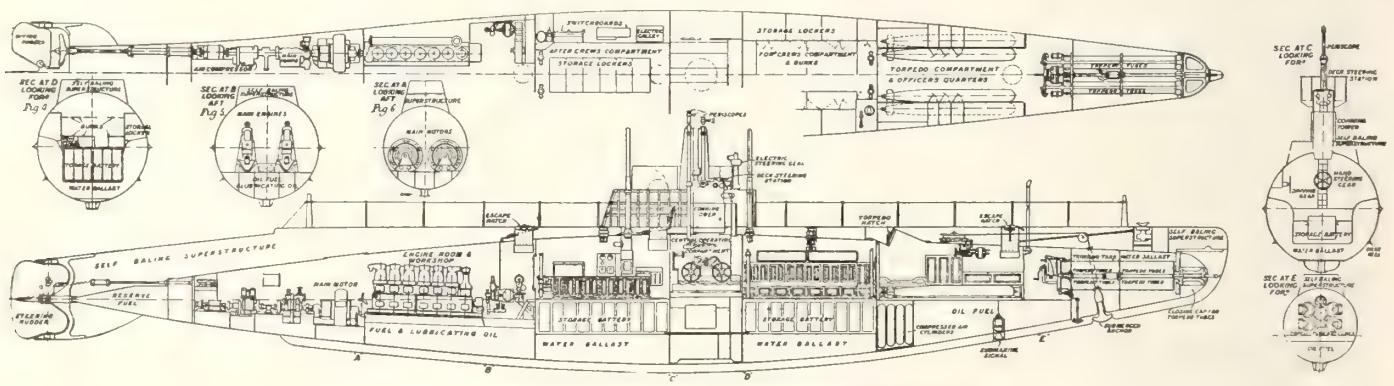
In a sense, the submarine is both an offensive and a defensive craft, but essentially it is the latter, since if we presume that submarines were capable of sinking all the large vessels of an opposing fleet, they would as at present constructed still be incapable of taking the offensive by bombarding an enemy coast or aiding in the landing of an expeditionary force on the hostile coast. Yet against this it has to be remembered that battleships or other surface vessels are in most cases unable to carry out such work, as has already been only too clearly seen during the present war.

Submarines, if in sufficient number, can always prevent the approach of transports, although they cannot destroy the submarines opposed to them. In fact, it seems that by a combination of a large fleet of submarines, the prolific laying of mines, and effective fort guns, it will be almost impossible for any Power however strong it may be on the sea, to allow its fleet to cover the landing of an army upon hostile shores. In other words, the submarine has added so enormously to the defensive power of any nation that in course of time an invasion by sea will become an impossibility, even in the case of those countries with a very long sea coast and a relatively small fleet.

Naval Predominance Affected.

So much has the submarine thus altered warfare that, from the purely naval standpoint, the predominant sea Power could never inflict a total defeat upon a minor sea Power in the sense of so completely destroying the smaller navy that a landing on a hostile coast could be effected by its aid; for even the destruction of all the submarines—a difficult enough task—would still leave the minefields and fort guns.

The submarine will, therefore, have a very strong influence upon military tactics in the future, and in particular for those countries which do not adjoin other countries with whom they may, under any conceivable conditions, be at enmity. It follows from this that the submarine has practically rendered Great Britain immune from invasion under any circumstances although it should be added that our submarine fleet has not yet attained such proportions as to guarantee this condition at the present time, and when it has there is always the distinct possibility that some new method of warfare will have been developed.



MODERN TYPE SUBMARINE DESIGN AND LAYOUT—I.

Destroying Submarines.

Submarines cannot destroy submarines, as battleships can destroy battleships, and according to past experience it is not by any means simple for any other type of craft to bring about the destruction of submarines in large numbers. It is true we can help in this direction slightly by building an enormous number of destroyers, but, on the

other hand, these are costly vessels in comparison with submarines, and the number required is so very large that one doubts if this method of attacking the submarine problem will ever be carried out on such a scale as to give security of feeling against the depredations of the submarine. The point of importance to be noticed here is that, whilst surface vessels must almost invariably act in flotillas, except, perhaps, very fast destroyers, which can escape from any slower boats, the submarine works most efficiently in single units, and this has been well shown by the recent German tactics.

The time is already here, therefore, when we should consider to what end the path along which all naval progress is tending will lead. We must open our eyes to the dangers of the future, and make preparations accordingly, not after peace has been declared, and we find we have given away some important points, but long before the question of the terms of peace is even discussed.

the submarine is the only vessel which renders this possible.

In naval battles fought before the advent of the submarine the percentage of hits with torpedoes was notoriously small. On ships stationary it was somewhat more successful, but very few vessels in motion were destroyed by torpedo attack. The destructive power of the torpedo, should it get home, is unquestionable, but its small speed compared with that of a shell is its great drawback.

The maximum velocity of a torpedo is not more than 45 knots, and this is reduced as the distance covered increases. Even the modern torpedo takes nearly three minutes to cover two miles, and in this time the relative speeds and courses of the passing vessels may be entirely altered, and large surface vessels would not approach one another so closely unless gun-fire had already done its work. It is only when used in a submarine that the torpedo is effective, and only then when the presence of the underwater vessel is undetected.

RANGE AND ACCURACY OF FIRE OF SHRAPNEL.

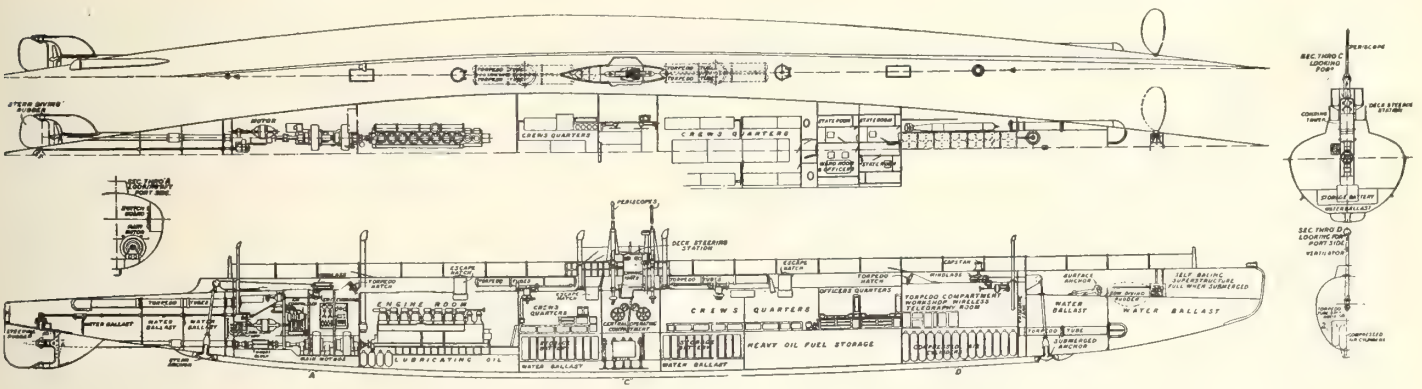
THE range of 3-in. shrapnel is from three to four miles, the velocity of the shell decreasing as the flight proceeds. With a muzzle velocity of 1,700—2,000 ft. per second, flight at maximum range occupies twenty to twenty-five seconds. The velocity of the shell is then about 700—750 f.s., to which is added 250—300 f.s. bullet velocity when the bursting charge explodes. At two or three miles range, an average Q.F. 18 pdr. field gun places its shells within a zone about 200 ft. by 18 ft., and, adding to this the zone covered by the bullets, it will be seen that shrapnel gives tremendous sweeping action over a concentrated area.

Error Producing Factors.

Factors preventing absolute accuracy of fire include variable wind resistance and resistance of driving band, varying recoil jump, and slight variations in shell weight and balance. Each degree Fah. above or below 80 degs. increases or decreases the muzzle velocity about 2.5 f.s., so that fuses must be correspondingly shortened in hot weather. Considering the immense number of variables concerned, it is remarkable what accuracy of fire is actually attained.

Among the error-producing factors which are under control are eccentricity and weight of shell. On these very close limits are naturally placed, so that as little sacrifice as possible is made in the accuracy of fire. The specifications of different governments differ somewhat, but the outside and inside diameters of the shell have generally to be concentric within two mils; the weight variation in bullets may not exceed 1 drm. (1.8 grms.) per lb., the permissible variation from standard weight of the filled case being plus or minus 1 drm. (adjusted by the matrix), and the completed shell, ready for its fuse, must be within 4 grms. (2¼ drms.) of standard weight.

To attain such perfection of result in complex products to be used by the tens,



MODERN TYPE SUBMARINE DESIGN AND LAYOUT—II.

We must now and onwards continue to develop submarines in this country with more urgency than ever before, and not only must much larger numbers be built in view of possible contingencies, but progress must be made with the type of submarine constructed, particularly in the matter of speed (which means progress in Diesel engine construction), and also in the possibility of under-water craft taking the offensive on a large scale.

GUNS v. TORPEDOES.

BEFORE the war started the gun was generally looked upon as the most effective weapon, but the success of submarines in the early stages of the war probably altered the balance of opinion. In making a comparison, it must be remembered that recent naval warfare has favored the use of the torpedo and given little chance to the gun. If the torpedo is to be a success at all it must be used at short ranges, and, generally speaking,

In the few naval engagements that have been fought in the North Sea, where it would be reasonable to assume that submarines would be valuable, their success has been nil, and the inference is that high speeds and good manoeuvring are all-sufficient to destroy the aim of the torpedo officer. Taking vessels destroyed during the war, slightly more have been destroyed by gun-fire than by torpedoes from submarines. The few isolated cases where surface craft have successfully launched torpedoes are quite special and cannot be taken as precedents. It can safely be predicted that when the big ship actions come, the victory will be obtained by gun-fire and gun-fire alone, and it is to these actions that the British Navy looks forward with every confidence.

The longer a gun is, the more the charge pressure of the powder is realized. Field guns are from 27 to 35 calibres long.

or even hundreds of thousands per day, demands the greatest possible care in the manufacture of every component part, and requires an organization, sustained effort, and performance of which our shops, machines, and our operatives are proving themselves thoroughly capable. In the abstract, the wastage of material, labor, and time involved is appalling, but if the price of victory be not paid swiftly and ungrudgingly, we are condemned to the far more frightful penalty of defeat, in yet greater losses of life and treasure, and in ultimate national destruction.—Engineering Review.

BREATHING PROVISION IN SUBMARINES.

THE personnel of a submarine depend for air for breathing purposes while submerged on the free air in the boat at the time of submerging and the compressed air carried in storage flasks, which is used in freeing ballast tanks of water as well as for breathing. In the average submarine in commission today, the air contained in the boat at the time of submerging is sufficient to last officers and crew, numbering 18 men, for a period of from 9 to 12 hours.

The air carried in the storage flasks is about sufficient to replenish the entire volume of air in the boat twice at atmospheric pressure, provided it is used for no other purpose. The maximum time during which all the air available can be breathed without serious effect is, therefore, from 30 to 36 hours. In computing this time, the safe amount of CO_2 that should be allowed to accumulate in the air at any time is taken at 2 per cent. Men vary, however, in their ability to withstand the effects of CO_2, the average man being able to withstand about 2½ per cent., while an exceptionally strong man can withstand as much as 5 per cent. Therefore, the time during which life can be sustained by the air in a given boat will depend somewhat upon the powers of resistance to the effects of CO_2 on the part of the personnel.

The air is maintained in condition for breathing by two methods:—First, by slowing bleeding from the main air supply into the boat and pumping air out very slowly; and, second, by allowing the air to become foul and then pumping a part of it out of the boat and replenishing it from the air flasks, at the same time maintaining a normal atmospheric pressure in the boat. The former method has been found more economical of air. The air in the boat is kept in circulation, as it has been demonstrated by experiment that air in circulation may be charged with a much greater percentage of CO_2 than still air without evil effect on the person breathing it.

Dominion Wreck Commission Investigations

Following the proceedings of a vessel stranding or collision inquiry is fascinating alike to the mariner and landsman. Much food for thought is always available, and in not a few instances it seems well nigh impossible to reconcile our conception of disaster prevention achievement when confronted with a detailed recital of the circumstances which contribute to many marine tragedies.

S. S. "HADDINGTON."

A FORMAL investigation into the causes which led to the grounding of the S.S. "Haddington" on the Eastern Reef of Red Island, in the River St. Lawrence at about 3.30 a.m., June 4th, 1915, whilst in charge of a Sailing Master named Joseph Blais, before Captain L. A. Demers, F.R.A.S., F.R.S.A., Dominion Wreck Commissioner, assisted by Captain Thomas O'Connor and Captain James Murray, acting as Nautical Assessors, was held in the Council Chambers, Kingston, Ontario, July 8th, 1915. Mr. Francis King appeared on behalf of the Master, R. J. Wilson, and the owners of the "Haddington," The Canada Steamship Lines, Limited.

Chief Witness Absent.

The chief witness, Josph Blais, did not appear, though summoned by his principals, upon instructions from the Wreck Commissioner. Nevertheless the inquiry was proceeded with, and the first witness examined, R. J. Wilson, the Master, deposed that he holds a master's certificate for inland waters, and a mate's certificate for coasting waters, and owing to his lack of qualifications as master, coasting, his owners engaged, through the representative of the Anticosti Island Agency, a man named Joseph Blais, holding a certificate as master in the coasting trade, who was signed on the articles as sailing master of the said vessel; that the "Haddington" was a steel built, single screw, vessel, with compound engines, capable of a speed of 10½ knots light and 9½ loaded, 1,010 tons net and 1,603 tons gross, Official No. 14367, carrying a crew of 19, including two properly certificated deck officers, and at the time of stranding was loaded with 1,908 tons of coal bound from Ashtabula to Gaspe.

After passing Cape Salmon he retired from the bridge leaving orders to be called if the weather became thick, the time then being 11.30 p.m. He did not go down to his room until 12.30, and he assumed that as the weather was perfectly clear and calm, he could absent himself from his post so as to have a sleep, having had but four hours rest in twenty-four, and desiring to be about after passing Bic Island. At 12.15 a.m. the first officer came on duty, and at about 3.30 a.m., on the 4th June, he the master was awakened by a shock, and immediately went up on the bridge, the ship having been stopped in the meantime, by order of the officer. The weather then was still perfectly clear and calm. The sailing master appeared excited, and gave as a reason for the grounding the excuse that he thought he had allowed sufficient in shaping his course, to clear the reef. It being flood tide the ship floated off, and when soundings were taken it was found that No. 1 hold was filling rapidly, and later No. 3 was found to be leaking.

Mate's Evidence.

The officer of the watch, Ernest Shannon, was next called and stated that he and the pilot were keeping watch and navigating the vessel from within the wheelhouse; that the compass was nearly correct; that the ship steered well, and was steered according to the directions of the sailing master; that the ship grounded in perfectly clear weather and smooth water, there being absolutely no wind. The sailing master gave orders to keep the vessel going ahead, notwithstanding the fact that she had struck; but he disregarded these orders and stopped the engines. The sailing master ordered the helm hard a starboard which was done; but the strength of the flood tide swung the ship to starboard and she floated off. The captain came on deck immediately after the ship struck.

Wheelman's Evidence.

The wheelman corroborated the statements of the previous witnesses as to the steering qualities of the ship and stated that he obeyed the instructions given to him. Under cross examination he hesitated to enlighten the Court as to whether the sailing master was piloting the ship by giving stated courses or by points of land; but he vouched that about half an hour prior to the stranding the sailing master told him to port two points. He was then steering NE by N. and this brought the vessel to N E by E; but whether he was told to steer that course or steer by some object then in sight he could not assert.

The Court, considering that the evidence already submitted was sufficient for its enlightenment, did not call

other members of the crew as witnesses, and adjourned sine die.

Court Finding.

The court having considered and weighed the evidence adduced, and notwithstanding the non appearance of the sailing master, elected to arrive at a finding as follows:

The master, R. J. Wilson, and his officers were strangers in the River St. Lawrence below Quebec, and the owners of the "Haddington," in order to relieve them of the responsibility of navigating the ship, on the recommendation of the Anticosti Island Agency, accepted the services of a man fully qualified insofar as he possessed a proper certificate to assume the navigation of the ship into the Gulf, and such being the case, we are of opinion that the master, in view of the exceptionally fine weather prevailing, was within his rights in securing as much rest as possible in order to be in a fit state to take charge in case of emergency, having left proper orders before leaving the bridge.

That the first officer, also a stranger in that locality, depended altogether upon the so-called pilot, and there was nothing to cause him to be suspicious of the efficiency of the pilot and the effectiveness of the courses given. Everything being in full sight, there was no cause for interference or remarks on his part.

Therefore, for the above reasons, we hold that neither the master nor the first officer, in charge, are to blame for this casualty and exonerate them from blame.

With regard to the sailing master, whose evidence has not been heard; but who was undoubtedly in full command at the time of the stranding, we hold that in view of the strong flood tide running at the time, he did not allow sufficient margin for the effect of much tide on his vessel. This in itself is considered an error of judgment. Had it happened in misty weather, when objects are indistinct, this court would have been inclined to simply censure him; but in this case, objects were visible plainly; but evidently bearings do not seem to have been taken, and estimations of distances were neglected.

In view of the above, we are of opinion that proper seamanship and good judgment was not exercised, and therefore suspend the master's certificate of Joseph Blais, sailing master of the Steamer "Haddington," for a period of four months for that reason.

For his contempt of court, Joseph Blais is liable to imprisonment, but the court will use the power which it has under statute, and further suspend his master's certificate for a period of two months, which in all precludes him from navigating a vessel as master or as officer of any grade, from the 8th day of July, 1915, to the 8th day of January, 1916.

By this finding we hope to cause all those who may be called upon to appear before the Wreck Commissioner's Court at a specified date, to obey the summons, whether given directly under the hand and seal of the Wreck Commisioner or through the principals, or agents, or owners of vessels casualties to which are being investigated by this Court.

S.S. "CABOT".

THE Court House, Sydney, C. B., was the location of a formal investigation on July 14, 1915, before Captain L. A. Demers, F.R.A.S., F.R.S.A., Dominion Wreck Commissioner, assisted by Captain R MacDonald and Captain A. J. Morrison, acting as Nautical Assessors, to inquire into the causes which led to the foundering of the S.S. "Cabot" in the Straits of Northumberland, about 13 or 14 miles south of East Point, Prince Edward Island, on the evening of June 24, 1915. Mr. Hugh Ross appeared on behalf of the Dominion Coal Company, owners of the S.S. "Cabot."

Master's Evidence.

The Master stated that the S.S. "Cabot" was a schooner-rigged, single-screw steam vessel of 162 tons net and 465 tons gross, capable of a speed of 5 to 5½ knots, carrying a crew of 14, including two deck officers and two engineers; that she was about 8 years old and had triple expansion engines, and drew 12 ft. forward, 11 ft. 6 ins. aft, light, and 12 ft. 6 in. forward and 13 ft. aft when loaded; that she left Charlottetown at 10 a.m. on June 14, light, bound to Sydney; that he was on deck more or less all the time, the weather being clear, with light winds; that he rounded Point Prim, passing inside of the buoy, close by, and shaped a course to pass Indian Reef, after which the course was altered to clear Bear Point at a distance of about 4 miles. At 6 p.m. the fog came on at intervals and remained so up to the time the ship foundered; that he left port without filling the tanks, as was customary in fine weather, but that about 9 p.m. he gave orders to fill them, which was done with the help of the pumps; that the vessel listed slightly as she ordinarily did when that operation was performed, and she came back on an even keel, but again listed, and as this was unusual the tanks were sounded, when it was seen that there was about 18 inches of water over No. 2 tank. The pumps were operated, but to no avail, the vessel continuing to list. In view of this the Master ordered the boat lowered, and called all hands on deck, the ship having a list of some 40 degrees when the crew got in the boat, the rail of the poop on the port side being nearly awash. He stated that whilst hanging on to the davit guy which had been freshly painted that day, he was swung overboard and that is the reason he found himself in the boat. Upon being recalled he averred that when in the boat he found there was one man left aboard the ship, and he returned in the dory with three others to get him off. The ship sank about 11 p.m., and they kept the boats before the wind, and were finally picked up by a schooner, after having been about 12 hours adrift.

Questioned as to a statement made by the Second Engineer, he said that to his knowledge there was no leak in No. 2 tank, nor were the pumps used every six hours to empty that tank.

He positively asserted that the ship never touched bottom nor struck any object, and therefore, his theory was that in the head sea prevailing the vessel strained herself and started some rivets, gradually increasing the injury so that a considerable flow of water took place, and that it was due to that that the ship foundered.

Second Officer's Evidence.

The Second Officer averred that he held no certificate; but had considerable experience at sea; that he had been on deck on watch from 12 to 4 and 6 to 8 on the day of the foundering; but not on the bridge, as the Captain kept his watch while he was busy about the decks; that he noticed nothing unusual; that the weather thickened intermittently about 6 p.m. until he went below. Upon being called on deck he found the vessel had listed to a sharp angle, and he went in the boat with the others. He was positive the ship did not strike whilst he was on watch.

Engineer's Evidence.

The Chief Engineer deposed that he joined the ship in March last: that the machinery was in good order; that he was on watch from 6 p.m. until the ship foundered, and when he noticed the ship taking an unusual list he sent the fireman to call the second engineer, the steam diminishing in the meantime. He came on deck without shutting the valve, knowing that the engine would stop on account of the diminution of the steam. It took from 1¼ to 2 hours to fill the tanks, which held 82 tons of water. Questioned as to the water which remained in the No. 2 tank, occasioning pumping, he was of opinion it was due to the fact that some water must necessarily stay in the tanks as the pump did not reach so close to the floor, and again it might be due to some dirt impeding the efficient working of the valves, and the probabilities were that the pipe joining the peak tank might be leaking at the joint.

Upon being recalled, he denied **in toto** the assertion of the Second Engineer that the tank—No. 2—had to be pumped every six hours for five minutes, if not regularly, at least frequently.

The Second Engineer asserted that he holds a fourth class certificate; that he had been in the Cabot for one year and seven months; that in his opinion the ship was leaking somewhere in the vicinity of No. 2 tank; that frequently, or almost every six hours, the pumps were in action for a period of five minutes on that tank. Questioned as to the amount of water which could be pumped in that interval of time—five minutes—he could not say offhand, but upon being told that the pumps would pump 4 tons in that time, he said it was possible. He could throw no further light on the matter, and his statement was not considered extremely satisfactory, being refuted by the chief engineer of the vessel at the time of the foundering, and also by his predecessor, who had been acting in that capacity for about two years prior to March last.

The Master also denied that such was the case, and stated that if pumping had been done, he was absolutely ignorant of it.

Finding.

The Court having carefully weighed the evidence adduced, which proved unsatisfactory in every respect, confesses that it remains in the dark as to the actual causes which brought about this casualty.

In reviewing the evidence of the Master, though he navigated his vessel inside of Point Prim Buoy, nothing in the evidence indicates that the vessel grazed the reef, thereby weakening the hull underneath of No. 2 tank, and if she had touched and injured that part of her hull it was evident the vessel would have received more serious damage further aft, as the ship was down by the stern.

The Court has questioned his action upon seeing the ship filling, for not steering his vessel towards the land, instead of keeping her head on to the sea. Though, in our point of view such method would have been a preferable one to adopt, it was only as a tentative way of trying to place the ship in shallow water; but owing to the water invading the engine room, steam being low, no speed could have been attained, and therefore, in view of these circumstances we cannot condemn the master for his action in this respect.

We look with askance at the fact that he was not the last man to leave the ship; that the wheelsman was left on board, even though he came back to his rescue. Owing to lack of other evidence, we are bound to accept his statement that he was swung overboard, and the davit guy slipped through his hand. It was providential that the boat happened to be handy.

With regard to the second engineer's evidence, which was contradicted by three witnesses, we are compelled to term his statement as an exaggeration. We are aware that the tanks cannot be thoroughly emptied; that there is a sweating process taking place within the ship; that leakages are bound to occur from connecting pipes, increasing gradually the volume of water.

The ship had been thoroughly inspected in the spring and a certificate of seaworthiness given. No reports were ever made by any one from the ship to the Company as to defects.

As no evidence was given to shed the least light on this matter, the Court has to make its own conjectures, based on the nautical experience of each member of which it is composed.

At some time during the voyage the vessel must have struck or grazed some submerged object, dislodging the heads of rivets, unknown to the crew; that no effects were seen till the vessel, encountering a head sea, increased the injury the ship had already sustained. This was accelerated by the fact that the tanks were empty, and were not filled until after the ship encountered the head seas which it was said were prevailing at the time. It appears that it was customary to leave port with the ballast tanks empty, this having been done by other Masters who were previously in command of this vessel.

Whilst we condemn that system, we cannot say that it was the direct cause of the foundering of the S.S. "Cabot," but it helped considerably, as had the tanks been full it would have served as a strengthening protection to the hull of the ship at moments of straining. Yet, if our theory is correct as to the possibilities of some rivets being loosened through unknown reasons, a leak would have sprung up later.

For lack of contradiction of the evidence adduced as to the way the ship foundered, whilst we question the methods adopted, it is our present duty to allow the benefit of the doubt.

With regard to leaving port without the ship's tanks being filled, whilst the vessel had no cargo, we consider the method unseamanlike, especially owing to the peculiar construction of this vessel, and the time it took generally to fill these tanks, viz., two hours.

We cannot overlook this phase of the disaster, and as we have before stated that this contributed to the foundering, we shall be lenient in our dealings with the Master, owing to the fact that it was a customary thing to do during the summer months, and therefore suspend his certificate for a period of three (3) months from the present date.

S.S. "ROMNEY."

ON June 29th, 1915, Captain L. A. Demers, F.R.A.S., F.R.S.A., Dominion Wreck Commisioner, presided over a formal investigation held at Quebec, to inquire into the causes which led to the grounding of the S.S. "Romney," on Green Island Reef, in the River St. Lawrence, on June 24th, 1915. He was assisted by Captain Jas. A. Murray, harbor master of the Port of Quebec, and Captain Francis Nash, of Montreal, acting as nautical assessors. Mr. A. R. Holden, K.C., appeared on behalf of the Shipping Federation of Canada; Mr. C. A. Pentland, K.C., on behalf of the master, and Mr. Romeo Langlais on behalf of the pilot.

Master's Evidence.

The master of the S.S. "Romney," Thomas Moss, the first witness called, stated that the S. S. "Romney" is a single screw, steel built vessel, of 2,816 tons net, with triple expansion engines, capable of a speed of 11 knots, carrying a crew of 56 all told, and is provided with all the necessary navigation instruments, including four compasses, one of which is of Lord Kelvin's make, upon which there is very little deviation.

From the time he left Liverpool he encountered more or less misty, thick weather; that during the ten days crossing until Sydney was reached, he had scarcely any rest, all hands having been kept on the alert while the vessel was in the war zone.

After leaving Sydney, Cape Breton, where he had gone to bunker, he encountered misty weather. He first sighted Cape Gaspe, then Cape Chatte, and finally made Father Point. He was on the bridge constantly during this time, and after having boarded the pilot, and passing Bic Island, he left the bridge after having given verbal orders to be called if the weather became thick or misty. While he left the bridge about 11.30 p.m., he did not retire to his room until 12.30, the weather being then overcast, with fresh wind from a north-easterly direction. He had informed the pilot that on the course S 67 W there was but one degree of deviation, which was not worth considering.

He was awakened by the ship striking, and rushed up on deck, and found that orders for the engines to be put full speed astern, had been given by the pilot; but notwithstanding this the ship remained fast. The tide was then ebbing, and soundings were immediately taken, and a call for assistance was sent by wireless, and the "Lady Evelyn" arrived and made efforts to pull the vessel off without success, until that night, when the ship was floated at high water, and proceeded to Quebec.

Pilot's Evidence.

Jules Lamarre, the next witness, stated that he had been a Quebec Branch Pilot for some 12 years, having had but one accident previously, which was not made the subject of an investigation, as it was trivial; that he had piloted the "Celtic King" down the day before, that he landed at Father Point, from the "Celtic King" on the morning of the 23rd, and attempted to rest; but owing to pains in his legs could not obtain any sleep; that the same evening he took charge of the S.S. "Romney," and steered the usual courses to Bic, and after passing that point shaped a course S 67 W, which, in ordinary circumstances would lead him between Red Island Lightship and Green Island. He saw a light half a point on his starboard bow; but could not distinguish its character, owing to the smoke from the ship obliterating its brilliancy, the wind being aft, or a little on the port quarter. The lookout reported breakers ahead, the helm was put hard a starboard, engines ordered full speed astern, and the ship grounded. Prior to this, he assumed that the light in sight was the lightship; but did not make sure by means of the glasses, that such was the case.

Upon being recalled, in answer to a question from the Court if it was not the case that he was asleep, or sleepy from the time he saw the light, he replied that such was the case, and that he had pains in his head, reiterating that he had no rest the day before.

Lookout's Evidence.

The lookout man avers that he reported two small lights indistinct on the starboard bow, then another nearer ahead on the starboard side, then two lights, which he assumed were lanterns, on the shore.

The quartermaster, Fitzpatrick, said the ship steered well, and he showed such remarkable memory for details that the Court did not attach much importance to his statement.

Finding.

The Court, having carefully inquired into the circumstances attending this casualty, finds that Captain Moss has given satisfactory reasons and explanations for his absence from the bridge prior to and up to the moment of the accident, and, therefore, exonerates him from blame.

With respect to the pilot, Jules Lamarre, the Court cannot—in view of his evidence and admission that he might have been drowsy or sleepy at the time, due to lack of sleep the day before, occasioned by pains in his legs—exercise any leniency.

Though many years a pilot, he evidently had not yet realized the extent of the responsibility he assumed when taking charge of a ship. We claim that it was his duty to inform the master of his temporary physical disability. Had he done so, it is not probable that the master would have left the bridge. We assume, and rightly so, that the statement that the smoke obscured the light is but an excuse, and not a valid one. We know that there are intermissions in the emission of smoke from the funnel, and during these intervals the light must have been visible sufficiently to show the difference between the light exhibited on Green Island and the one on the lightship, or on Red Island, each one of which is of a different type.

Accepting the evidence adduced that the lightship and Red Island lights were not visible, owing to mist, the difference in the exhibition of these lights and their character is great enough to be observed in a moment, especially in the almost normal climatic conditions which existed that night, lights being seen at a distance of four miles.

We cannot conceive for a moment how such a mistake could be made by any one, unless under aberration, momentary or otherwise, or whilst under a sleepy spell, the pilot having admitted being in the latter state.

As we said at the outset, leniency is out of the question, and, therefore, for his lack of attention to duty, which has caused a loss of thousands of dollars, we suspend the pilot's license of Jules Lamarre for a period of six months, from the 29th day of June, 1915, to the 29th day of December, 1915, and further order him to pay the sum of one hundred dollars towards defraying the costs of the investigation.

With regard to Second Officer Cooper, we find that he showed a marked indifference in the navigation of the ship. His orders were to call the master if it became thick or hazy; if the character of the light could not be discerned owing to smoke obscuring it, and we are of opinion that it was his right and duty to advise the master; further, when such a condition existed, and he should have shown sufficient interest to refer to the chart or sailing directions, as, had he done so, he could have pointed out to the pilot that he was piloting the ship into danger. It is in such times as this that the officer on duty should assure himself that the pilot is right, besides increasing his knowledge of the conditions existing in the waters he is called upon to navigate.

We repeat that Second Officer Cooper has shown an extraordinary and most lamentable indifference in the accomplishment of his duties; and, while we will not deal with his certificate, we severely reprimand him, and caution him to be more careful in the future and exercise that intelligence and caution which every master expects from those he entrusts with navigational duties.

This Court wishes to point out that in dealing apparently in a lenient manner with the second officer, it recognizes the peculiar situation created by the war, which has reduced the number of officers available to a minimum, therefore causing untold delay to vessels in carrying out their schedule.

SUBMARINE EFFECTIVENESS DUE TO THE TORPEDO.

THE principal offensive weapon of the submarine is the torpedo, an extremely intricate mechanism built along the lines of the submarine itself, but automatic in its action after leaving the tube from which it is fired. The torpedo is divided into four main parts—the head, air flask, afterbody, and tail. The head contains the explosive and the mechanisms to fire it. Abaft the head is the air flask. This contains the compressed air for the propelling machinery.

In the next division of the torpedo is found the depth-controlling mechanism, the air superheater, the main propelling engines, the steering engines and gyroscope, and the shafting to the propellers, as well as the rods to the rudders. The tail inside contains the gear wheels for the propellers, while on the outside are the supporting parts for the propellers, the diving rudders and the vertical rudders.

ROYALTY AND THE RIVETER.

THE following humorous incident falls to be recorded in connection with the recent tour of inspection of our King among the Clyde shipbuilding and engineering establishments. At a particular yard the foremen were being presented, and when it came to the foreman riveter's turn, the introduction was effected in the following words:—"The foreman riveter, your Majesty, who controls the men giving most trouble at present in the shipyard." The King, with that kindliness which so won the hearts of the war workers, remarked "And I suppose you are having a rather difficult time in controllling your men just now." The foreman's reply was certainly convincing, if somewhat unexpected: "If yer Majesty had the handlin' o' them for a week ye wad ken something about it."

Big Chances. — Skipper of tramp steamer (having lost his bearings on a dark, stormy night, and trying to get his position on an old and filthy chart)—If that's Cardiff, Bill, we're orl right; but if it's a fly spot, 'eaven 'elp us!

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MARINE DISASTERS BECOMING COMMONPLACE.

THE present year will, we are safe in saying, be a record one in so far as marine disasters are concerned. Arising out of the war, naval and merchant vessels, large and small, and of every class and type have been ruthlessly sunk, and in a majority of cases with a shockingly high percentage of their passenger and crew complement drowned. War on the sea is grim sport and it is being pursued with intense enthusiasm, patriotism notwithstanding.

Secretary MacNamara, of the British Admiralty, in a recent announcement, states that since the beginning of the war and up to puly 7, some 1,550 persons have been killed or drowned as the result of German submarine attacks on British merchantmen. The total includes the Lusitania victims. Again, in the matter of vessels sent to the bottom as a result of the war, an official statement from Berlin gives 229 British ships, 30 other hostile craft, 6 neutral vessels sunk by mistake, and 27 additional of the latter sunk because they carried contraband. As regards warships sunk and lives lost, public records are unreliable because incomplete. What we do know, however, although it be but a fringe of the whole truth, bears ample evidence that in both the material and human life aspect, the merchant marine losses pale into insignificance in comparison.

The foundering of the Titanic and Empress of Ireland, and the wholesale destruction of our lake shipping nigh two years ago on account of the great storm in early November, are events not to be quickly forgotten and their lessons given practical effect to. We do seem to quickly forget, however, and in the matter of profit to slowly, if at all, appropriate any. Far from the war zone loaded with a precious freight of human life on pleasure bent, and with disaster apparently as far removed as is conceivable, the steamer Eastland, belonging to the St. Joseph-Chicago Transportation Co., and chartered by the Indiana Transportation Co., for the purpose of the Western Electric picnic, capsizes practically at her moorings in Chicago harbor and drowns what is variously estimated to total some 1,500 souls.

As already indicated, this was no war zone tragedy, therefore no lurking death-dealing torpedo from a submarine can be blamed. A cause there was, nevertheless, and just whether its location will eventually be established, we hesitate to meantime express an opinion. Investigations are now in process. One feature of this latest disaster that cannot have escaped notice, although more or less common in all happenings of a similar nature, but magnified in the present case enormously, is the rashness with which statements concerning the vessel's stability and therefore seaworthiness have been bandied about in the daily press, and by, for the most part, men who are as little intimate with ship construction as they are about crossing the Sahara Desert. Never since shipbuilding came into being with its attendant small and great disasters have such raw, weird tales been spread abroad about any craft as those that have appeared in the daily press following the Eastland capsizing. Everybody seems to have known that the illfated vessel was untrustworthy, and as if such guilty knowledge were not enough to be silent about, there must needs be added a recital of the steps taken to manipulate pumps and ballast tanks to keep the vessel on even keel; to wit, to prop her up.

It is inconceivable that all of the aspersions cast on the Eastland's character can bear the light of proof, but even if they should, where is all of our boasted efficiency and "safety first" development progress. Expediency in its multitudinous opportunities for exercise, makes "cowards of us all" in too many instances, so much so that even less than half-hearted action may sometimes be taken where efficiency and safety first demand a live conscience and fully concentrated effort. If expediency in any direction made the Eastland tragedy possible, then expediency of another kind should not only be a deterrent to but put beyond the range of possibility its repetition. "Safety first" on board-ship is perhaps more urgent than under any other set of circumstances, and should the foundering of the Eastland accentuate its importance to the designers, constructors, navigators, owners and managers of either freight or passenger craft, or both combined, then this latest marine tragedy with its shocking toll of human life may not have been altogether in vain.

MARINE NEWS FROM EVERY SOURCE

Midland, Ont.—The new locks at Port Severn were officially opened on July 26. This point is the Georgian Bay end of the Trent canal.

Kingston, Ont.—The steamer City of Hamilton, which broke its propeller near Montreal on July 16, and had to be assisted up river by the steamer Calgarian, went into the Kingston Shipbuilding Co. dry-dock.

Kingston, Ont.—After being in commission for 25 years or more, the Dominion Public Works dredge 105 is to be placed on the scrap heap at Ottawa. For the past 8 months this dredge has been engaged deepening the harbor at Bowmanville.

The Prince Rupert, B.C.—The Board of Trade published its annual report for 1914, together with general information as to the resources of the district of northern British Columbia. The report contains an interesting review of trade and commercial conditions at Prince Rupert, and indicates opportunities for industrial development.

The Steamship Matoa, which was purchased by the George Warren Transportation Co., has been cut amidships to permit it passing through the Lachine Canal to Montreal. The two sections will be floated together at the Canadian Vickers Co.'s dry-dock, and the ship prepared for the trip to Boston, Mass., where she will engage in ocean trade.

Quebec, Que.—After being stuck hard and fast in the mud, a little above Three Rivers, from early morning, July 6, the Canada Steamship Lines steamer Quebec was refloated the following evening. The vessel, which had run some distance on the bank a mile and a half above Three Rivers, was pulled into deep water by five tugs, the Magnolia, Hudson, Alaska, Spray and Rosalie.

Sarnia, Ont.—The burning of the freight sheds of the Port Huron and Duluth Co. in the former place means a great gain to the citizens of Point Edward, as the freight of that line is now being handled through the local shed there, being thre loads out and in per week. The freight up to this time had been slow, but, with two fleets landing here, business now amounts to about ten thousand tons per week.

P. & O. Liner at Montreal.—The recent arrival in the port of Montreal of the P. & O. liner Peshawur aroused great interest among the local shipping community, as well it might do, seeing that no P. & O. liner has ever been in the St. Lawrence before. The explanation of this unprecedented event is, of course, that the vessel is in Admiralty service, and has perforce to steam far from her usual tracks.

Charles S. Price Wreck Buoyed.—A horizontal, striped gas buoy has been placed at the wreck of the steamer Charles S. Price, which lies in about 60 feet of water 10⅝ miles 17 degrees true from Fort Gratiot lighthouse station. The buoy is cylindrical in shape, with pyramidal skeleton superstructure, and shows a flashing red light of 40 candlepower 12 feet abobve the water. Flashes of thre seconds alternate with eclipses of seven seconds. There is a minimum depth of 23.5 feet of water over the wreck.

St. John's, Nfld.—The purchase by the Russian Government of the ice-breaking steamer Bruce from the Reid Newfoundland Co. is announced. It is understood that the Bruce, with her sister ship, Lintrose, bought by Russia last winter, will be used in the White Sea during the fall and winter in an effort to keep open later than usual the channel to the port of Archangel. The Bruce and the Lintrose were built a few years ago for service in Cabot Strait, between Newfoundland and Cape Breton, where heavy ice is encountered in the winter. They are steamers of 1,553 tons.

Sarnia, Ont.—The change in running of Northern Navigation steamers to Detroit and Windsor will not affect this port. The boats will stop here on their down trip, unload at Point Edward, load again, and then go to Detroit the night before sailwing, where they will take on passengers at that point. They will then touch Windsor and return to this port, from which they will sail on their present schedule. On the down trip passengers will be taken off at the wharf here and will go the rest of the way on White Star boats. The boat from Toronto will operate here.

Too Big for Canal.—William G. Davidson, president of the Staten Island Shipbuilding Co., has just purchased four of the large vessels of the Erie Railroads Lake Line, the Brownell, Underwood, Binghampton and Oswego. President F. D. Underwood of the Erie Railroad has made announcement of the sale. The big vessels are too large to go through the Welland Canal, so they will be cut in two and towed through in that manner. The cutting will be done in Buffalo, and the approximate cost of the cutting, towing and insurance will be $25,000. The boats will be used in the coastwise and trans-Atlantic trade.

British Vessels Lost.—During June, British vessels, respecting the loss of which reports were received at the Board of Trade, numbered 98, a net tonnage of 39,736, the lives lost numbering 111, made up as follows:—Sailing 35, net tonnage 5,347, lives lost 23; and steam 63, net tonnage 34,389, lives lost 88. The particulars regarding sailing vessels include 13 vessels, of 3,803 tons, sunk by German warships, resulting in the loss of five lives, and those for steam include 50 vessels, 27,343 tons, sunk by German warships; four steamers, 2,406 tons, sunk by mines; and one steamer, sunk by a German warship or a mine. The lives lost in steamers sunk by German warships numbered 47; in steamers sunk by mines 12, and in steamer sunk by German submarine or mine 1. The figures include 12 sailing vessels, 933 tons, and 13 lives, and three steamers, 82 tons, and two lives lost in vessels belonging to British possessions abroad.

New Lighthouse and Fog Signal Station.—The new Canadian light and fog signal station marking the intersection of Amherstburg and Livingstone Channels, in the lower Detroit River, was placed in service on July 15. The lighthouse stands on a square concrete pier constructed in eighteen feet of water in the Detroit River, at the head of Livingstone Channel, about 200 feet south of

the intersection point of the east edge of Livingstone Channel and the west edge of Ballard Reef or Amherstburg Channel, in latitude north 42 degrees 8 minutes 9 seconds, longitude west 83 degrees 7 minutes 21 seconds. The tower is of reinforced concrete, white and square, surmounted by an octagonal iron lantern with red roof. The light is at an elevation of 42 feet above the level of the river, and is of the fourth dioptric type. Petroleum vapor burned under an incandescent mantle is the illuminant. The beason shows a white light ten seconds, alternating with a red light five seconds' duration, and is visible for eight miles from all points of approach. The fog bell is mechanically operated, and will give one stroke every five seconds in thick or foggy weather. Gas buoy No. 79 D, which formerly marked the intersection of the channels, has been withdrawn.

Scarcity of Coal Freighters.—The Sydney Record says that owing to scarcity of ships, it understands that negotiations are in progress between the Dominion Coal Co. and the Intercolonial Railway for the shipment of a large tonnage of coal from Sydney to Quebec and Montreal by rail. Owing to a quietness in freight business, it is considered possible an arrangement will be concluded at a tariff profitable to the railway and satisfactory to the Coal Co.

U.S. Shipbuilding.—Merchant vessels built in the United States and officially numbered by the Bureau of Navigation, Department of Commerce, during the fiscal year ended June 30, 1915, were 1.226 of 215,711 gross tons compared with 1,291 of 311,573 gross tons for the fiscal year 1914. Steel construction during the last fiscal year amounted to 121,-501 tons for the fiscal year 1914. The number of steel steamers built last year was 68, against 104 in 1914. There was a very noticeable decrease in lake shipbuilding.

Lumber Boom Break.—It is calculated that considerable loss will be occasioned by the breaking of the lumber booms in Miramichi, N.B., recently. Strenuous efforts are being made to round up the stray logs, but a large number have drifted out to sea. Thousands of dollars were also lost by fishermen whose nets were carried away by the logs. When taken in tow, the logs are placed in the nearest boom, irrespective of marks, and sawn by the mill at that place. The lumber surveyors tally each log as it comes in and the whole business will be adjusted finally on a clearing house basis.

Canadian Ice Breakers.—Eleven men who signed last April on the papers of the sturdy little Canadian oceanboing tug and ice-breaker, J. T. Horne, at Halifax, to take the vessel to Archangel to deliver it to the Russian Government, returned recently to Halifax by the Russia-American liner Dwinsk. The men state that the Canadian ice-breaker Earl Grey, which was sent to Russia for service at Archangel, did good work, but finally broke down, one of her boilers going out of commission. She went to England for repairs, but is once again in the far northern port, ready when winter comes to resume her labors.

Reporting Defects in Navigation Aids.—The United States Lighthouse Service has recently devised a form of printed post card for the use of mariners in reporting unsatisfactory condition of aids to navigation, which, it is believed, will be useful in obtaining prompt information regarding these. The card is printed in such form that it is simply necessary to insert the name of the vessel reporting, with name of aid to navigation, and date and time when observed, together with any desirable additional remarks, and forward to the lighthouse inspector concerned. This arrangement will be given a trial in the fifth lighthouse district, with headquarters at Baltimore, Md., and, if found satisfactory, its use will be extended to other districts.

THE ATLANTIC IN WAR TIME.

IN the harbor at St. John or Halifax, according to the Canadian Gazette, may be seen a number of the old square-rigged Canadian sailing vessels loading up for England. These relics of the nautical past are helping to fill the gap made by "orders of the Admiralty" in the ranks of the regular cargo boats. There is money in the business. British importers of Canadian timber, for instance, have now to pay £6 10s. per standard of 165 cubic feet for freight from St. John to Old Country ports.

One old "tub," to use the irreverent phraseology of the modern gold-laced officer in the merchant service, was sold not dong ago for $8,000. In one trip alone this same "tub" is said to have cleared $12,000 profit! An iron sailing vessel that cost $25,000 is said to have made $35,000 on its first trip across the Atlantic. Old "salts" who have been living on shore for many years have again donned their oilskins. A boot and shoe merchant, who had not sailed a ship for twenty years, sold his store, bought an interest in a brig, skippered it himself across the Atlantic, and cleared up $3,000 in a month. No more boot selling for him, he declares. The Atlantic is an interesting highway these war days!

Book Reviews

Submarines, Torpedoes, and Mines, by W. E. Dommett, 106 pages 7¼ inches, 21 illustrations and 16 full size plates. Published by Whittaker & Co., London, and New York, price 25c net. This is the second impression of an exceedingly interesting little volume, especially so at the present time when the work of submarines is so much before the public. The author states that in the preparation of this book, the endeavor has been to present the subject in such a manner that it shall be understood by, and together with the plates, be of interest to the general reader, and at the same time contain sufficient technical matter to be of value to the reader having some technical knowledge. The latter feature, however is limited to some extent by the necessity for secrecy enjoined by the various governments or private yards building submarines. That the book is up to date is proved by the reference to incidents of the present war; viz., the action at Heligoland Bight and the feat of the B. 11 in penetrating the Dardanelles and torpeding a Turkish warship. The book contains ten chapters with the following headings:—Historical, British naval submarines, submarine tactics, steering and manoeuvring apparatus, propelling plant, armament, navigation fittings, routine on submarines, mines, and lastly auxiliary vessels. It will be noted from the above that submarines and their constructions have been covered quite comprehensively. The plates sixteen in number, are excellent reproductions and show various types of submarine craft, while twenty-one illustrations show the propelling engines and other details. Among the latter is included a folding plate illustrating the interior of a submarine. The chapters on torpedoes and mines are also equally interesting, the illustrations being of considerable help to a clear understanding of the text.

UNITED STATES SHIPBUILDING.

(Continued from page 138.)

an unusual degree, and if the occupation of the wooden tonnage in deep-sea trade continues it is probable that new orders will be accepted on which construction will start before sonwfly.

Bath shipbuilders are of the opinion that their worst and most formidable obstacles are not evolution, but the mistaken policies—if they may be called policies—of the lobby navigators in Congress and their ideas of what conduces to the welfare of the American seaman. Down in Maine they have an idea that the bes thing that can happen to the American seaman is a state of affairs which will permit the operation of vessels so that he can secure employment.—N. Y. Journal of Commerce.

PRINCE RUPERT DRY DOCK.

THE big dry dock at Prince Rupert, constructed by the Grand Trunk Pacific Railway in conjunction with the Dominion Government, is expected to be ready for service by August 1st. The dock, which has cost $2,500,000, consists of three units, with a total capacity of 20,000 tons. There will be two end sections of 5,000 tons each, and a middle section capable of accommodating a 10,000-ton vessel. All the units are interchangeable, and each dock is complete in itself, with pumps and air compressors. By employing the three sections together a 600-ft. steamer can be dealt with.

In addition to the actual dock there are five other features of the plant, namely, the foundry, which will be able to make castings as heavy as 12 tons; a boiler shop for marine repairs as well as for the construction of boilers; a machine shop; a ship shed and carpenters' shop; and a power-house equipped with two large turbo-generators and a 1,500 cu. ft. per min. air compressor. Construction work in connection with the dry dock and its accompanying plant has been under way since the beginning of 1912.

STEAM-ELECTRIC DRIVEN DREDGE

THE New York Engineering Co. has received an order for a dredge, the design of which presents interesting features. Details published in the "Engineering and Mining Journal" indicate that the hull of the dredge will be built more on the lines of a ship than the usual dredge hull. The machinery will be electrically driven, the electric power being generated by a steam turbo-generator.

The dredge is designed to dig 55 feet below waterline, and to stack 35 feet above the waterline, and it will have a clay chute placed directly over the screen, so that barren material overlying the gold-bearing gravel may be by-passed instead of going over the gold-saving tables. The digging ladder is of the solid plate-girder type, 110 feet long by 9 feet at its deepest part. The buckets for the dredge are of one piece of manganese steel, the lip being cast integral with the rest of the bucket and designed to wear as long as the back and hood. This is considered feasible in the sort of ground this dredge will dig.

The 12-in. high-pressure pump will be driven by a 125 h.p. motor direct connected, and the 14in. low-pressure pump will be operated by a direct-connected 75 h.p. motor. Besides these, there will be fire pumps and the usual accessory pumps for the power plant. A travelling crane, separate stacker hoist, and other modern equipment will be provided. It is stated that the total cost of the dredge when erected will be about $250,000.

Canadian Vessel Captains and Chief Engineers

Through the courtesy of the various Steamship Companies, we are enabled to give a list of 1915 season vessels, together with the names of their principal officers.

CHATHAM NAVIGATION CO., CHATHAM, ONT.

Vessel.	Captain.	Chief Engineer.
Ussifrage	T. J. Stockwell	George Peel

C. P. R. DETROIT RIVER CAR FERRIES, WINDSOR, ONT.

Vessel.	Captain.	Chief Engineer.
Ontario	R. Brown	F. Merrill

ONTARIO CAR FERRY CO., LTD., MONTREAL.

Vessel.	Captain.	Chief Engineer.
Ontario No. 1	F. D. Forrest	J. A. Nicoll

OTTAWA RIVER NAVIGATION CO., MONTREAL.

Vessel.	Captain.	Chief Engineer.
Duchess of York	E. P. Shepherd	F. Piche
Empress	A. Blondin	A. L. deMartigny

CANADIAN LAKE AND OCEAN NAV. CO., TORONTO.

Vessel.	Captain.	Chief Engineer.
Scottish Hero		H. C. Harrison
Turret Cape		J. J. Dove
Turrett Court		J. S. Duguid

FORWARDERS', LTD., KINGSTON, ONT.

Vessel.	Captain.	Chief Engineer.
Port Colborne	W. Steeves	J. H. McMillan
Port Dalhousie	Jos. Napier	L. McMillan
W. H. Dwyer	J. P. McLeod	J. Silverthorne

DARTMOUTH FERRY COMMISSION, DARTMOUTH, N.S.

Vessel.	Captain.	Chief Engineer.
Chebucto	N. Wallan	C. Pearce
Dartmouth	J. Hare	C. Shortt
Halifax	W. Jennex	A. McLeod

CAPE BRETON ELECTRIC CO., SYDNEY, N.S.

Vessel.	Captain.	Chief Engineer.
Electronic	I. H. Lewis	B. Dixon
Hygeia	J. Brown	A. Campbell
Peerless	A. McLeod	J. B. Weeks

C. P. R. UPPER LAKES SERVICE, PT. McNICOLL, ONT.

Vessel.	Captain.	Chief Engineer.
Alberta	F. J. Davis	C. Butterworth
Assiniboia	Jas. McCannel	A. Cameron
Athabasca	J. B. Currie	G. D. Adam
Keewatin	M. McPhee	W. Lewis
Manitoba	J. McIntyre	R. Sinclair

F. E. HALL & CO., MONTREAL.

Vessel.	Captain.	Chief Engineer.
Byron Whitaker	E. Tremblay	F. Patterson
Carleton	E. Groulx	E. Scott
Stanstead	D. McLachlan	M. J. McFaul
Compton	B. Bowen	L. Smith
Robert R. Rhodes	W. H. Ransom	F. A. Collier
Sinbad	J. C. McCarty	A. Theriault

G. T. P. COAST STEAMSHIP CO., VANCOUVER.

Vessel.	Captain.	Chief Engineer.
Henriette	H. L. Robertson	F. Davies
Prince Albert	W. S. Morehouse	R. Bell
Prince George	D. Donald	I. O. Handy
Prince John	C. W. Wearmouth	A. S. Munro
Prince Rupert	D. Mackenzie	D. G. Ferrier
Escort No. 2	T. Foster	J. Taylor

G. T. R. DETROIT RIVER CAR FERRIES, WINDSOR.

Vessel.	Captain.	Chief Engineer.
Detroit	R. Aikin	H. Lowry
Great Western		J. Ladds
Huron	M. Bausette	A. Cook
Lansdowne	H. Oldenberg	W. Belsom
Transfer	G. Honner	W. Taylor
Transport	W. Worrell	F. Robinson

QUEBEC AND LEVIS FERRY CO., QUEBEC.

Vessel.	Captain.	Chief Engineer.
Charles H. Shaw	P. Levesque	J. Michaud
John S. Thom	A. Lessard	A. Dion
North	A. Labadie	E. Boivin
Pilot	P. Levesque	W. McMillan
Polaris	A. Lessard	N. Lamontagne
Queen	A. Labadie	P. Ouellet
South	G. Fortin	A. Barron

GREAT LAKES TRANSPORTATION CO., MIDLAND, ONT.

Vessel.	Captain.	Chief Engineer.
Calgary	J. H. Solery	T. Walker
Glenfinnan	W. Linton	C. McWilliam
Glenfoyle	W. Taylor	J. P. Davidson
Glenlivet	F. Burke	W. McWilliam
Glenlyon	A. Hudson	D. Sinclair
Glenmavis	J. Dix	E. Shaw
Glenshee	W. Levigne	F. Goodwin
Glentay	T. Anderson	J. Jackson
Major	S. Carson	W. McCabe
Toiler	F. A. McMann	G. Price

REID-NEWFOUNDLAND CO., ST. JOHN'S, NFLD.

Vessel.	Captain.	Chief Engineer.
Argyle	G. O'Reilly	T. Moyst
Bruce	G. Spracllin	F. C. Barnes
Clyde	J. Knee	J. Pollock
Dundee	D. Blandford	H. Crawford
Ethie	J. Day	P. Burton
Glencoe	A. Blandford	E. J. Birch
Home	S. Harbin	J. Cunningham
Kyle	B. Taverner	Jas. McFarlane
Meigle	J. Goobie	Jno. McFarlane
Sagona	N. Kennedy	J. Roberts

C. P. R. B. C. LAKE AND RIVER SERVICE, NELSON, B.C.

Vessel.	Captain.	Chief Engineer.
Bonnington	G. Robertson	T. F. McKechnie
Hosmer	F. L. Orr	A. McLeod
Naramata	J. W. Weeks	J. P. Sutherland
Nasookin	W. Seaman	D. H. Biggam
Proctor	G. Graham	P. H. Pearse
Rossland	A. Forslund	J. Fyfe
Sandon	M. P. Reid	N. Hawthorn
Sicamous	W. Kirby	W. Jacobs
Slocan	W. Wright	D. McLeod
Valhalla	Jas. Ferguson	T. C. l'Anson
Whatshan	J. Fitzsimmons	W. Edwards

WINDSOR A NOR. NAV. CO. TERMINAL.

THE importance of Windsor, Ont., as a lake port was made further evident on July 22 by the announcement of H. H. Gildersleeve, General Manager of the Northern Navigation Company, that, beginning immediately Windsor and Detroit would become the southern terminal for the company's steamers Noronic, Huronic and Hamonic, which make weekly trips to the Soo, Port Arthur, Fort William and Duluth.

The change of the southern terminal from Sarnia to Detroit and Windsor was brought about by the activities of the Windsor Board of Trade. General Manager Gildersleeve was reached in Montreal where he had gone to make arrangeemnts with Grand Trunk Railroad officials for the use of the Brush street wharf in Detroit. He said the company's steamers would start from Detroit, and after crossing to Windsor would start on their voyages to the north.

SCOTTISH SHIPBUILDING.

THE output of new mercantile tonnage continues small, and the Clyde total for the half-year now closing is the lowest for a considerable time back. As a matter of fact, however, statistics are at present of no comparative value; so that, while it may be said that the Clyde total for the half-year now closing is less by 79 vessels and 128,704 tons from that of 1914, and by 77 vessels and 209,502 tons than that of 1913, this does not by any means indicate that trade has been poorer to the extent shown. When it is possible to give the complete figures for this half-year it will be seen that there has never been such a period of activity in the history of the river.

In the Clyde total there are included one steamer of over 8,000 tons, one of 5,000, one of 2,970, one of 1,350, and one of 500; a dredger of 1,500 tons, a tug of 122 tons, a barge of 75 tons, and a small motor boat.

NEWFOUNDLAND TRADE.

THE transfer to the United States and Canada of a large amount of the trade ordinarily carried on between Newfoundland and Great Britain is one of the results of the war. This arises from the changes in the shipping situation.

The gradual withdrawal of trans-Atlantic steamers from the port of St. John's because of the transport needs of the British Admiralty and the requirements of British trade has reached a point where only three small steamers are now plying between St. John's and Liverpool. These are freight vessels of the Furness Line, with practically no passenger accommodation.

The latest reduction in the service is the taking off of the Allan Line steamers, which for nearly fifty years have plied between Glasgow, St. John's, Halifax and Philadelphia. These ships, the Mongolian, Carthaginian, Pomeranian and Sardinian, are to be transfered to the route between Montreal and British ports.

Business men have necessarily made new connections in Canada and the United States, and steamers making weekly trips between St. John's, Halifax and New York are laden to the hatches.

CANADIAN SHIPBUILDING IN 1914.

ACCORDING to the list of vessels built and registered in Canada as issued by the Department of Marine and Fisheries, 1914 was a fairly active year in ship construction. In the '70's of last century, when the wooden sailing ship was still the glory of the seas and a main carrier of ocean-borne commerce, the measurement of vessels turned out of Canadian yards ran up towards 200,000 tons a year.

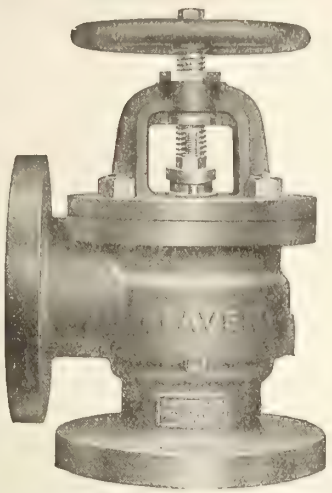
The steel tramp that on a low consumption of coal could push its way through the water at a speed of eight miles an hour or so was getting its start, however. It was better adapted to the needs of a growing commerce, and if on the ocean highway it could not keep up with the fine clippers and great three and four-masted sailers, it had other advantages which made it the fittest, and its old-type competitor could not survive. From 1874, when 190,756 tons was added to the registry, there was a gradual decline till 1896, when the additions to the list only measured 16,146 tons.

When the development of trade on the Great Lakes began to call for a larger class of steamers than had heretofore been employed, Ontario began to advance as a ship-owning and ship-building province, and has of late years been the chief contributor to the record. Last year the measurement of the new vessels was 43,346 tons, the largest figure in fourteen years; and of the whole, 23,167 tons was credited to Ontario.

The increase in the total of vessels registered was, however, only 35,457 tons, there being a reduction on account of the loss, sale or breaking up of older craft. According to the record the number and tonnage of vessels registered in Canada at the close of 1914 was as follows:

	Vessels.	Tons.
Ontario	2,100	314,660
Quebec	1,663	259,143
British Columbia	1,591	147,192
Nova Scotia	2,098	135,053
New Brunswick	1,052	55,522
P. E. Island	149	10,029
Manitoba	103	7,999
Yukon	11	2,295
Saskatchewan	5	529
Total	8,772	932,422

The average size of the registered vessels, it will be noted, is just over 100 tons. There are ships of large capacity on the list; but the majority are schooners for fishing barges, and even smaller craft, that some countries do not enter on their records of ships. They all serve a useful purpose, however, and play their part in the work of transportation of one kind or other.



Made in sizes 2½" to 10" in stop or non-return angle or cross valve pattern.

MORRISON'S Beaver Angle Valves

A high-class valve specially designed for high pressure steam. Iron Body, Bronze Mounted, with regrinding or renewable copper disc valve. Seats are renewable and fitted with set screw to prevent their working loose.

Recessed spigoted joint between body and yoke prevents gasket blowing out.

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ASSOCIATION AND PERSONAL

A Monthly Record of Current Association News and of Individuals Who Have Been More or Less Prominent in Marine Circles

Sir Sandford Fleming, engineer and scientist, died at Halifax on July 22, after a short illness, at the age of 88. Sir Sandford was known as the dean of the engineering profession in Canada and the "father of the Canadian Pacific Railway." Sandford Fleming was born in Kirkcaldy, Fifeshire, Scotland, on January 7, 1827. He was educated there, and came to Canada in 1845. He joined the engineering staff of the Northern Railway, Toronto, subsequently becoming chief engineer. Later he practised engineering in Ontario, and was elected a member of the Institute of Civil Engineers, London, and of the American Society of Engineers, and elected honorary member of the Canadian Society of Civil Engineers. In 1863 he was chosen by the Governments of Canada, Nova Scotia and New Brunswick and Great Britain to conduct a survey for the first link of a railway which would join the Atlantic and the Pacific. His survey showed the practicability of the scheme, which developed, when carried out, into the Canadian Pacific Railway system. He helped to build the railway system of Newfoundland. In recognition of his public services Queen Victoria made him a Companion of the Order of St. Michael and St. George in 1877 and a Knight Commander in 1897.

Captain Geo. S. Laing, 290 Robert St., Toronto, has been appointed honorary agent for Canada of the Imperial Merchant Service Guild, whose headquarters are the Arcade, Lord street, Liverpool, England. The purpose of the Guild is to unite into one great body the certificated captains and officers of the British Empire marine, and thus enable them to have a direct voice and interest in the making of laws and formulating of regulations pertaining to their calling. The present membership of the Guild is 16,000 and it has to its credit a reserve fund of $190,000.

VON SPEE'S VERSION OF CORONEL SEA FIGHT.

FULL eight months late, as an echo of the days when portions of the German fleet were still abroad on the high seas and naval battles were not the rare occurrence they are to-day, the report of Vice-Admiral Count von Spee, commander of the cruiser squadron of which the Scharnhorst and Gneisenau were a part, concerning the battle between the Germans and the British off the Bay of Arauco, Chile, near Coronel, has reached the Admiralty.

The naval engagement, in which three English cruisers and an auxiliary cruiser and two German cruisers and three smaller vessels took part, occurred on November 1, 1914. Vice-Admiral von Spee's account was written on November 3. How it has taken eight months to reach Germany, and where it has been in the long intervening months may never be made known. One by one the German ships concerned, the Scharnhorst, the Gneisenau, the Nurnberg, the Leipzig, and the Dresden, have met their fate. The report follows:

"The squadrons under my command consisting of the large cruisers Scharnhorst and Gneisenau and the small cruisers Dresden, Nurnberg and Leipzig, steamed on the 1st of November about twenty miles from the Chile coast, at a twelve-mile rate, toward the south in order to catch an English cruiser which, according to reliable information, had anchored off Coronel the night before. On the way several smaller cruisers were detached from the squadron to look for approaching steamers and sailing vessels.

"At 4.15 in the afternoon, bent on such a mission, the Nurnberg was out of sight to the northeast, and the Dresden was approximately twelve miles to the rear. With the rest of the squadron I stood about forty miles to the northeast of the Bay of Arauco.

British Squadron Sighted.

"At 4.17 there were sighted in the west and to the south, two vessels, and at 4.25 a third, about fifteen miles distant from us. Two were finally recognized as warships, probably the Monmouth and the Glasgow, while the third probably was the auxiliary cruiser Otranto. They seemed to be taking a southerly course. My squadron pursued them with all pos-

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sible speed, keeping them about four points to starboard. The wind was blowing a full gale from the south. A correspondingly high sea was running, so that I strongly preferred to guard against being forced into the lee position.

"The course chosen served also to cut off the enemy from the neutral coast. At 4.35 it was noticed that the British ships were bearing more westward and I followed eventually in a west-southwest course, the Scharnhorst gradually overtaking them at a speed of twenty-two miles, while the Gneisenau and the Leipzig lagged behind. The lively wireless exchange of the enemy was disturbed as much as possible.

"At 5.20 the arrival of another warship was made known. This vessel took the lead at 5.30, and was recognized as the Good Hope, the flagship of Rear Admiral Cradock. The enemy's line at once straightened out, ran up its flags, and attempted slowly to close on a southerly course. From 5.35 onward I held to a southwesterly course, under diminished speed to allow my other ships to catch up.

"At 6.07 the two lines stood nearly parallel to one another on a southerly course, a little over 14,600 yards apart. The Dresden was about one mile behind, and the Nurnberg was far to the rear. At 6.20, at a distance of 13,400 yards, I turned one point toward the enemy, and at 6.34 at a range of 11,260 yards, I opened fire.

The "Good Hope" Hit.

"Wind and swell were head on, and the vessels had heavy going, especially the small cruisers on bith sides. Observation and distance estimation were under a heavy handicap, because of the seas which washed over the bridges. The swell was so great that it obscured the aim of the gunners at the 10.5-centimeter guns, on the middle deck, who could not see the sterns of the enemy's ships at all, and the bows but seldom.

"The guns of both our armored cruisers, on the other hand, were effective, and by 6.39 already we could note the first hit on the Good Hope. I at once resumed a parallel course, instead of bearing, as before, toward the enemy. The English opened their fire at this time. I assume that the heavy sea made more trouble for them than it did for us. While we ran parallel and later, as it grew dark, when we increased the distance between us, their two armored cruisers remained covered by our fire, while they, so far as could be determined, hit the Scharnhorst only twice and the Gneisenau only four times.

"At 6.53, when only 6,500 yards apart, I ordered a course one point away from the opponents. They were firing more slowly at this time, while we were able to count numerous hits. We could see, among other things, that the top of the forward turret of the Monmouth had been shot away and that a violent fire was burning in the turret. The Scharnhorst, it is thought, hit the Good Hope about thirty-five times.

Sought Torpedo Attack.

"In spite of our altered course, the English changed theirs sufficiently so that the distance between us shrank to 5,300 yards. There was reason to suspect that the enemy despaired of using his artillery effectively, and was manoeuvring for a torpedo attack. The position of the moon, which had risen at 6 o'clock, was favorable to this move. Accordingly I gradually opened up further distances between the squadrons by another deflection of the leading ship at 7.45.

"In the meantime it had grown dark. The range finders on the Scharhorst used the fire on the Monmouth as a guide for a time, though eventally all range finding, aiming and observations became so inexact that firing was stopped at 7.26. At 7.23 a column of fire from an explosion was noticed between the stacks of the Good Hope. From that time, as it seemed to me, that vessel fired no more. The Monmouth apparently stopped firing at 7.20.

"The small cruisers, including the Nurnberg, received by wireless at 7.30 the order to follow the enemy and to attack their ships with torpedoes. Vision was somewhat influenced at this hour by a rain squall. The light cruisers were not able to find the Good Hope, but the Nurnberg encountered the Monmouth, which steamed at first ahead and then parallel with her. At 8.58 the Nurnberg was able, by shots at closest range, to capsize the Monmouth, without a shot being fired in return. Rescue work in the heavy sea was not to be thought of, especially as the Nurnberg immediately afterward believed she had sighted the smoke of another enemy ship and had to prepare for a new attack.

"The Otranto turned about as soon as the first shot struck her and later apparently ran away at full speed. The Glasgow was able to keep up longest its fire, even though it was ineffective, and succeeded in escaping in the darkness. Both the Leipzig and the Dresden thought they saw several salvos of hits strike her.

"The small cruisers had neither losses nor damages in the battle. On the Gneisenau there were two men slightly wounded. The crews of the ships went into the fight with enthusiasm; every one did his duty and played his part in the victory."

Six weeks later came the news that the day previous Admiral Graf von Spee's squadron had been destroyed in the Falkland Islands battle, the Admiral himself going down in his ship, the Scharnhorst.

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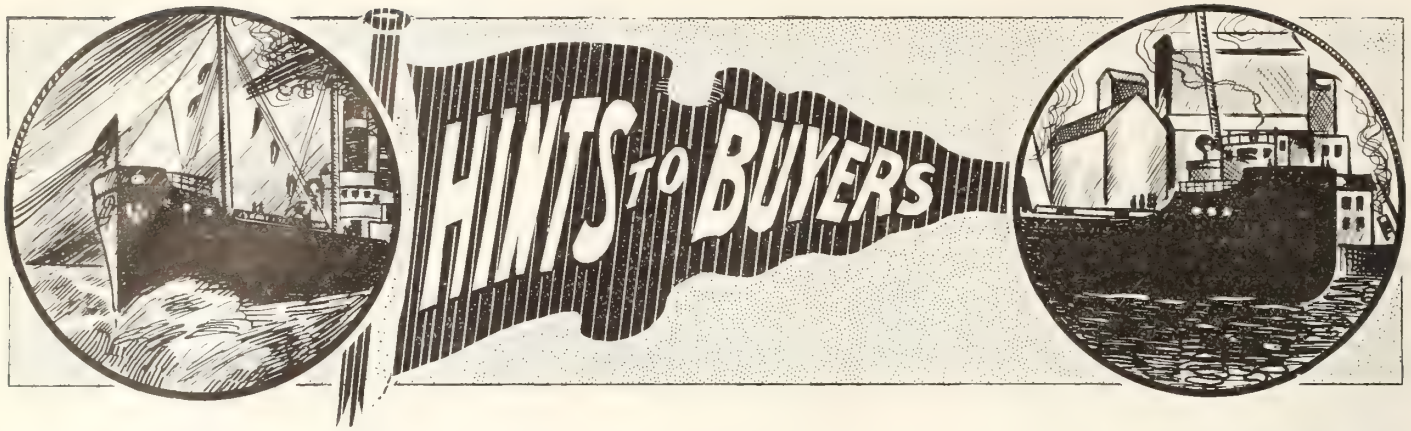

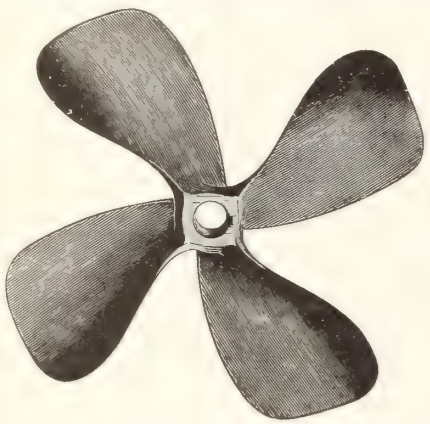

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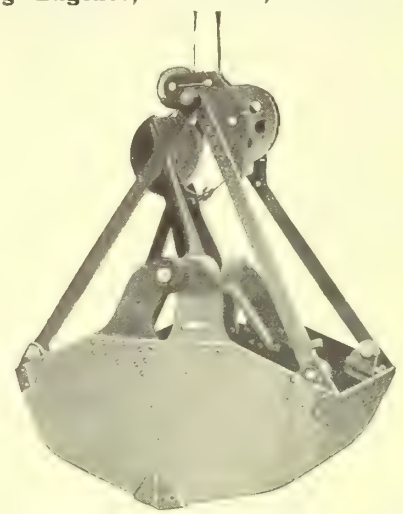

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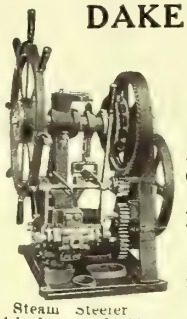

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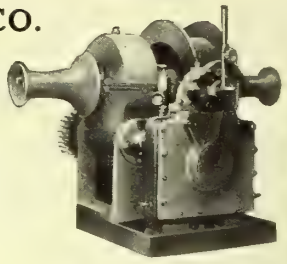

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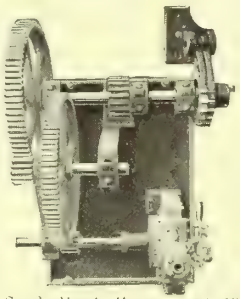

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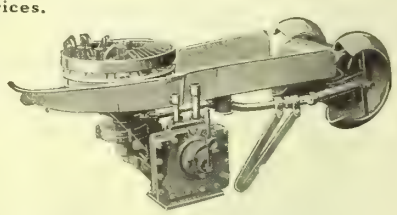

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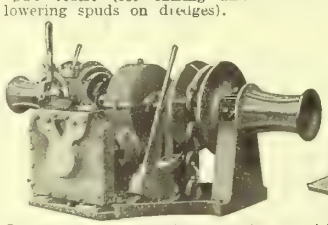

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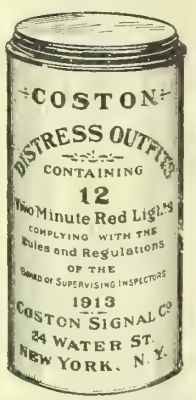

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The Publisher's Page

By B.G.N.

"When Nations Advertise for Armies"

JOHN H. FAHEY, president of the Chamber of Commerce of the United States, at the recent meeting of the Associated Advertising Clubs of the World, said in part:

"If there are still extant men who ask the question, 'Does it pay to advertise?' I know their thinking is of the kind which would lead them to light factories with candles and insist upon the advantages which would accrue if the residents of modern cities still drew their water supply by bucket from the town well.

"When nations in the greatest struggle of history advertise for armies; when kings and emperors and sultans come down from their thrones to seek the attention of the world and present their pleas and defenses through the press; when it has become the daily bread of a large part of the world's business, it is indeed a man of limited mentality who still questions the power of publicity. Its value to society has in fact so impressed itself that to-day publicity is the light of the world. It may be said, with little element of speculation in the assertion, that if publicity had characterized dealings between the nations of Europe during the last fifty years, and secret diplomacy had been eliminated, the present world war, with its terrorism and threat to all civilization, would not now be raging.

"The power by which hundreds of thousands of minds, yes, millions of minds, may be turned to consideration of the same thing at the same time is a wonderfully useful influence. Whether that power is employed to make millions think of the policies of the government or the homely comforts and economies affecting their daily lives, the underlying value of this power is the same; the advantages to be gained from its use are identical.

"It is often contended that you cannot advertise successfully when business is bad, but the extent to which confidence may be restored and enthusiasm reawakened by enterprising advertisers under adverse conditions was demonstrated again and in remarkable ways during the period of uncertainty which prevailed in our own country immediately after the first of last August. Once more it has been shown that the public demand for commodities always exists in greater or less degree. It is simply a question of brains and ingenuity in securing response under conditions a little harder than usual."

MARINE ENGINEERING
143-153 UNIVERSITY AVE. ∴ TORONTO, ONTARIO

The advertiser would like to know where you saw his advertisement— tell him.

Can. Govt. New Buoy and Lighthouse Steamer "Grenville"

This recently completed vessel gives ample indication that Canadian shipbuilders are not only maintaining their reputation as capable exponents of the dual crafts of naval architecture and marine engineering, but are also advancing correspondingly with the world-wide development taking place in these particular spheres of industrial enterprise.

THE Department of Marine and Fisheries, Ottawa, has recently placed in commission the new buoy steamer Grenville, her station being at Prescott, Ont. The vessel is of steel construction throughout, with cruiser stern, and was built under special Canadian Government and British Board of Trade survey. She is also classed as 100 A1 at Lloyd's. The hull is divided by six main transverse watertight bulkheads. The Polson Ironworks, Toronto, built and engined the Grenville. The following are among the principal vessel dimension, constructional and equipment features:—

Length between perpendiculars, 155 feet.

Length over all, 164 ft. 6 in.

Breadth moulded, 30 feet.

Depth moulded, 13 feet.

Draught loaded, 9 ft. 6 in.

Coal bunker capacity, 100 tons.

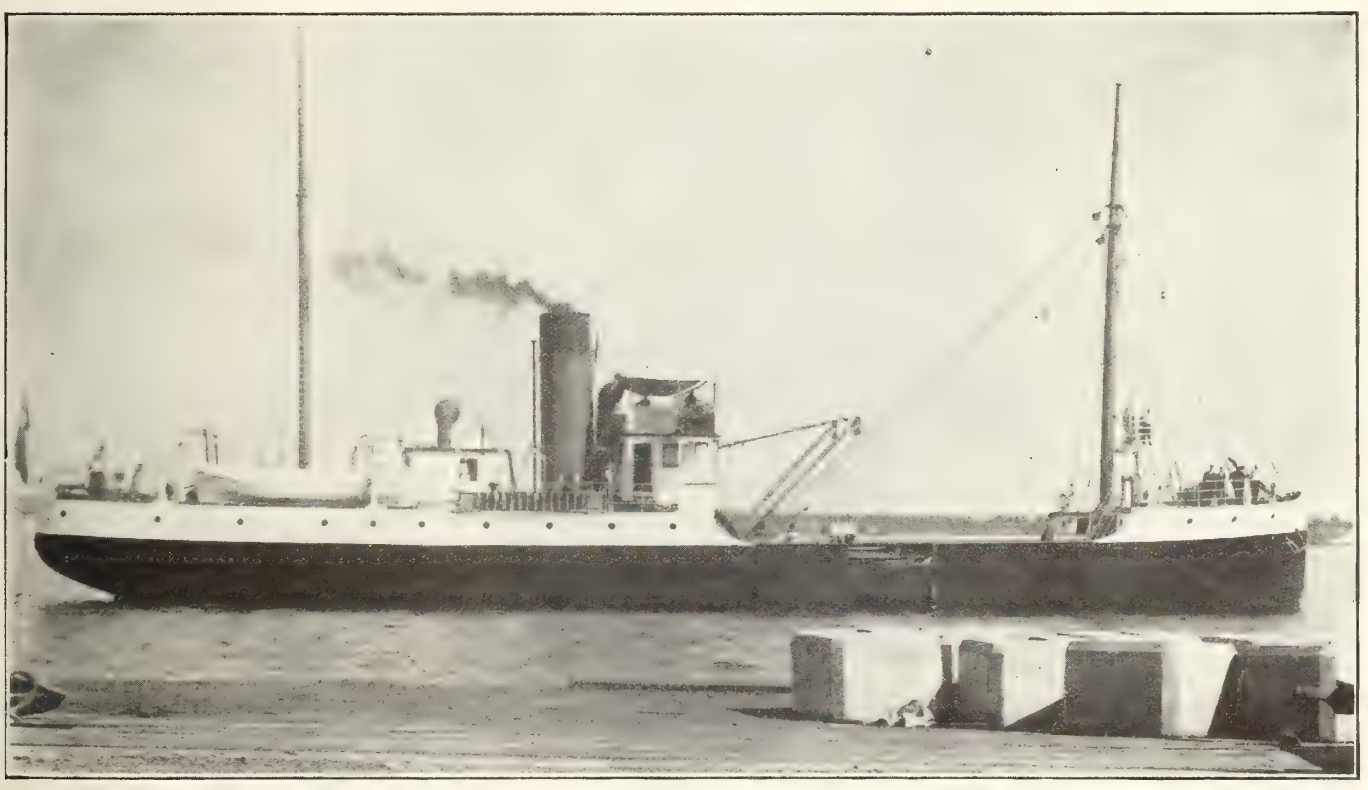
Complement—Officers and men, 24.

The Grenville has a single screw driven by a triple expansion jet condensing engine, with cylinders 14 in. and 22½ in. and 38 in. diameter by 24 in. stroke, the three cranks being set at angles of 120 degrees. The designed indicated horse-power with propeller making 185 r.p.m. is 900. The boiler equipment consists of two Scotch type single-ended boilers, each 10 ft. diam. by 11 feet long, the total heating surface of each boiler being 2,260 square feet and the working pressure 180 pounds per square inch. The boilers are fitted with Morrison's corrugated furnaces, and Howden's forced draft system is installed. A "Weir" twin beam air pump operates in connection with the jet condenser. The boiler feed pumps are also of "Weir" make, being of the vertical, direct-acting type. A "Weir" bilge pump and multiplex surface feed water heater are also installed. Further engine room equipment consists of general service duplex pump, having cylinders 9 x 5½ x 15-in. stroke, and a 9 x 9-in. ballast pump. A 6-in. "See" ash ejector is installed in the boiler room.

The deck machinery consists of large and small derricks and winches, boat hoist and steam winch, windlass, a 16,000 c.p. searchlight, etc. The engine room telegraph is of "Chadburn" make, and the compasses and nautical instruments were supplied by Kelvin & White, Glasgow, Scotland. Electric light is installed throughout the vessel, current being furnished by a 15 k.w. and a 20 k.w. direct connected vertical steam engine and generator; both units were supplied by the Canadian General Electric Electric Co., Toronto. The refrigeration plant was supplied by the Canadian Griscom-Russell Co., Toronto.

The vessel is fitted up in first-class style, all furnishings and equipment being of the best possible description. She has four decks, lower, main, bridge and forecastle. On the bridge deck are the captain's quarters. The mess rooms are on the main deck on the port side and the officers' quarters are on the starboard side. The main dining saloon is aft of the companion-way, and on the main deck forward are the deck stores and cold storage, while the crew's quarters are forward on the lower deck. The bunker capacity is about 100 tons, being filled through coaling scuttles on the main deck.

The hull is of steel throughout, and is fitted with rubbing keels of 70 feet length. The stem is made of rolled steel and the stern is an iron forging. The rudder has an area of 40 square feet, and consists of steel plate on a forged frame. The Grenville carries two masts, the lower portions being of steel and the top section of wood. The foremast is fitted with a 15-ton steel derrick operated by a winch located for-



CANADIAN GOVERNMENT LIGHTHOUSE AND BUOY STEAMER "GRENVILLE."

ward. There are also two 2-ton derricks on the main deck. The fresh water tanks, two in number have a total capacity of 18,000 gallons. The gross tonnage of the vessel is 497 tons, and registered tonnage 232 tons. The keel was laid in April 17, 1914, the launch took place on November 7, 1914 and the trial trip was made on April 26, 1915.

BARGE TRANSPORTATION IN COURT.

RECENTLY, Mr. Justice Bailhache delivered judgment in the action brought by Reid & Co., Montreal and Glasgow, against Smith's Dock Co., ship repairers and shipbuilders, for the sum of £3,525 alleged to be due to plaintiffs under a contract to transport a steel-screw grain barge and elevator and deliver it at Quebec to the Quebec Harbor Commission. The barge was built by the defendants, and by a letter dated 3rd October, it was agreed that the barge would be ready to leave England on June 30, but did not go on her trial trip till that day, and she was not in fact ready till July 30. Defendants counterclaimed against the plaintiff for the sum of £763 which they had to pay for the insurance of war risks on the vessel.

In giving judgment Mr. Justice Bailhache said the building contract was that the builders were to construct a steel-screw barge and elevator, with its machinery and outfit; all classification fees were to be paid by the builder: that the elevating machinery was to be tested at Quebec to the satisfaction of the purchasers; that the vessel was to be insured for "all risks" by the builder in the name of the purchasers, and there were certain clauses as to an extension of the time for building. The result of the agreement was that the barge was to be ready for delivery on June 30, after she had successfully performed her trial trip. The elevating machinery was to be tested, however, in Quebec, the Commissioners not being bound to take delivery till that was done.

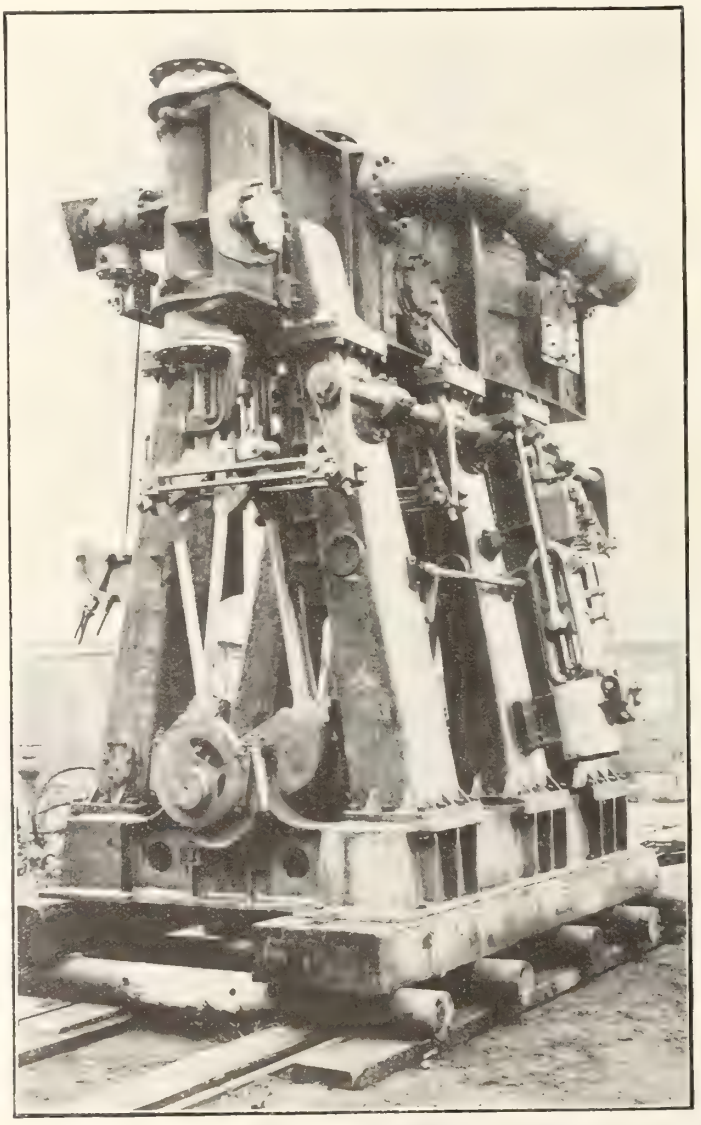
The War Intervened

Owing to the delay in building the vessel she was not ready till the end of July, a time when war had already been declared between Austria and Servia, and it was found that Britain might be involved in a great European Struggle. The builders, who had contracted to insure the vessel against "all risks," decided to insure for war risks, but no quotations could be obtained at the time, owing to the general unsettlement, and the steamer did not get away till September 13, the result being that owing to other circumstances her machinery could not be tested, and the final acceptance was left over till the following year.

Under these circumstances the plaintiff now sued the defendants for the sum of £3,525 agreed to be paid for transporting the vessel, stating that he had not to wait for the testing of the machinery. Mr. Reid contracted with the defendants to take the vessel to Quebec, and to undertake as it said in one of the letters "all the responsibility and expenses in connection with the delivery at Quebec." It had been contended by the plaintiff that this agreement referred to the mere transport to Quebec, but he (the judge) held that the words meant a great deal more than that. He held that, in making this contract, Mr. Reid understood that from the time of making it he would put himself in the defendant's place, and perform all the duties which they (the defendants) owed to the Quebec Commissioners so far as related to the transfer and delivery of the vessel. Mr. Reid had not, of course, to pay for remedying any defects, but he had to carry out the duties named, and these he had not performed.

This appeared clear from the fact that the sum of £3,525 was to be paid for Mr. Reid's services, whereas the quotation made by Messrs. Smith for the transport of the craft was only £1,600. Then Mr. Reid said that it was an implied term of his contract that the ship should be ready on June 30, and that it was in consequence of the delay in getting the vessel ready that the contract had not been fulfilled, but he (the judge) did not agree with this view. With regard to this question of delay the defendants pleaded that the terms of the contract gave them a long extension of time for delivery, and he considered after taking all the circumstances into account that they had shown they were entitled to this extension so as to save themselves from being said to have broken the contract. The result was that the plaintiffs' claim for £3,525 failed.

As regards the counterclaim for the insurance of the vessel, he held that the undertaking of the defendants to insure against all risks justified them in insuring against war risks. Judgment would, therefore be for the defendants on the claim and counterclaim with costs.



ENGINES OF THE C. G. S. "GRENVILLE."

The last two of the twenty-three reinforced timber and concrete cribs which will form the foundation of the new Dominion Government dock on Burrard Inlet, Vancouver, were placed in position on July 15th. The filling in of the great central area with sand from the mouth of the Fraser River is being done by several large clam-shell dredges, and work will soon be commenced on the huge warehouse sheds which will line both sides of the 800-foot dock. Upon the filled-in surface between the sheds there will be laid seven railway tracks. Work is being pushed vigorously on the foundations for the big grain elevator.

The "Bonecourt System" of Surface Combustion Explained

Staff Article

In many parts of Canada the unfortunate combination of a cold climate and scarcity of fuel has to be met by the industrial interests. Any marked attainment in fuel economy will therefore be welcomed by all public spirited citizens. The system herein described has not only obtained remarkable results but the extra apparatus required is very simple and, in some cases even less expensive than that applicable to the older methods employed.

THE recent general acceptance in Europe of the principle that the use of raw coal as fuel is inexcusably extravagant has given more or less impetus to the design of plants that will use gas or other products of the distillation of coal. There is no doubt that the methods of burning coal which we have used for so many years are extremely wasteful of an enormous quantity of by-products, some of which are really detrimental to the heating value of the coal when burned as such.

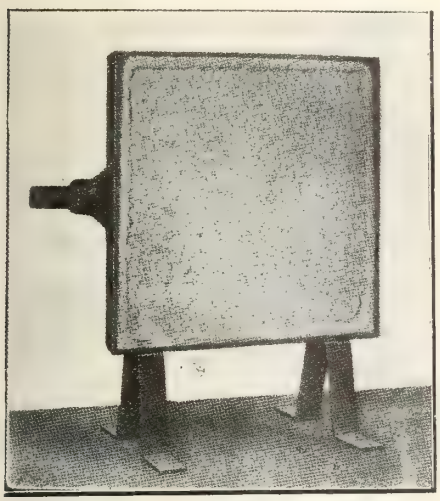


FIG. 1.—DIAPHRAGM UNIT WITH CHAMBER AND PIPE ATTACHED.

The Bonecourt system of surface combustion is eminently suited to the use of gas as fuel, and obtains its advantage over other systems of combustion in several ways. First, gas and air are thoroughly mixed in the exact proportions required for perfect combustion, so that no air or gas will be left over after the process is completed. This does away with the necessity of admitting excess air to the furnace and incurring its consequent cooling effect. In the ordinary coal furnace, the excess air amounts to at least 50 per cent., and this, along with incomplete combustion, constitutes a serious loss, which is entirely avoided by the use of surface combustion. Second, the flame is eliminated. Flame is a mixture of air and combustible gases in different stages of combustion, and when it comes into contact with a cool surface the process ceases to a certain extent and combustion is incomplete. Again, in the glow of surface combustion, all of the available heat is present in the form of radiant energy, and can be readily absorbed by the material to be heated.

When air and gas are mixed in the proper proportions, a very explosive mixture is formed, and one of the chief difficulties to be overcome in perfecting this system was the tendency to premature explosion of the fuel. There are two successful methods of producing flameless combustion, both of which are equally useful for different purposes. In the first or diaphragm method, the mixture of gas and air is forced under a light pressure into a chamber, the one side of which is composed of a wall of refractory material which is more or less pervious to the gases. The gaseous mixture is lighted over the whole outer surface of this porous diaphragm as it comes through and causes it to glow uniformly with a red flameless heat. This method is used for cooking and similar processes, or the diaphragms may compose several of the walls of a furnace for heating dies, tools, etc.

The other method of burning the mixture without premature explosion is to force it through nozzles upon a surface composed of small pieces or granules of refractory materials. Combustion takes place upon the surface of these granules, which become incandescent, and the mixture is delivered at such speed that it cannot burn back into the nozzle. This method is largely used in furnaces for annealing purposes and heating metals. A great advantage of the process is that no damage can be done to the materials to be heated by the products of incomplete combustion, which may be either carbon or oxygen. If the carbon is in excess, the product CO is very poisonous; while if unburned oxygen is present, scale is formed on all metals while being heated, and such products as enameled ware are ruined by coming into contact with it while in the heated condition.

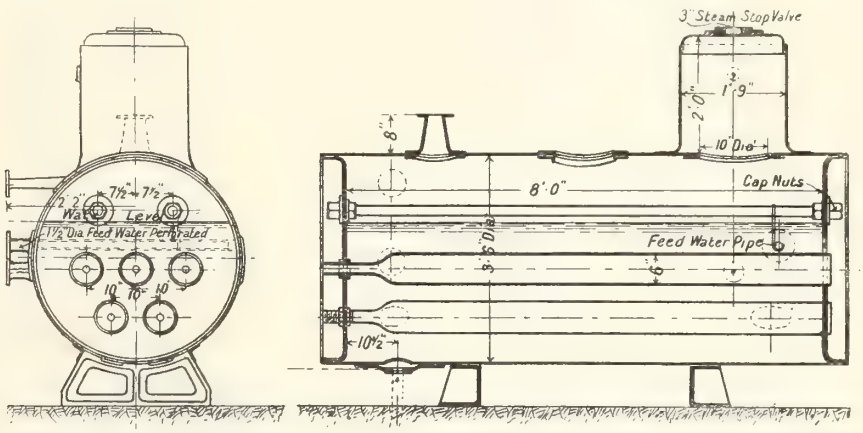


FIG. 3.—"BONECOURT" BOILER FOR ILLUMINATING GAS, SHOWING TUBES.

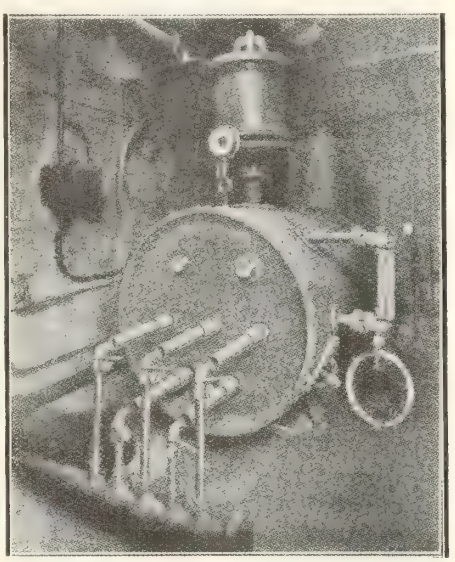


FIG. 2.—BOILER USING ILLUMINATING GAS.

Steam Generation.

Coming now to the question of steam generation by means of surface combustion, it will be recalled that there were published some two or three years ago for the first time the results of the trial of a small boiler which had been installed in Leeds for firing with coal gas. This boiler was made purely as an experiment, but some particularly striking performances were obtained with it. An

efficiency of 94 per cent. when steaming at the high rate of 20 lb. of water evaporated from and at 212 deg. per square foot of heating surface per hour was claimed. The official report of a German deputation, after carrying out a series of tests on a similar English boiler, announced an efficiency of 93.8 per cent. when fired with coal gas and

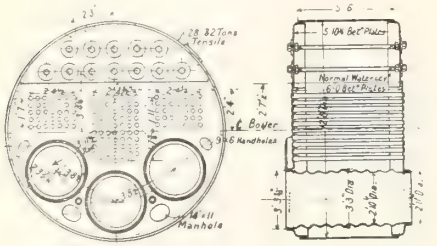


FIG. 4.—BOILER FOR TRIAL WITH BLAST FURNACE GAS.

evaporating water at the rate of 35.2 lb. per square foot of heating surface per hour from and at 212 degrees under a pressure of 144 lb. per square inch.

The gaseous mixture is supplied to the refractory packing in the boiler tubes through holes of relatively small bore in fire-clay plugs situated in the entrance ends of the tubes. In order to cause the gaseous mixture to pass through these holes at a speed requisite to prevent back ignition, it is necessary to maintain a certain pressure difference between the entrance and exit ends of the boiler tubes. This pressure difference, in normal cases, lies between 10-in. and 30-in. water gauge, and may be produced either by supplying the gas and air under a positive pressure or by drawing off the products of combustion from the exit end of the boiler by means of a suction fan.

Experiments have been made with various kinds of industrial gases and with different sizes and constructions of boiler tubes. The general principles throughout are as above described. The tubes are larger than ordinary boiler tubes, and are furnished with a refractory packing in the form of lumps or granules. This packing serves to hasten the combustion and, at the same time, plays a very important part in the transmission of heat from the zone of combustion to the water surrounding the tubes. The heat transfer takes place partly by way of radiation from the incandescent granules and partly by reason of the baffling effect of the hot granules on the swiftly flowing gases. The atmospheric air drawn through the openings under the action of the suction carries, and thoroughly mixes with, the gaseous fuel.

Firing With Illuminating Gas.

These principles will be made clear by an examination of Fig. 2, which is a photograph of a boiler recently installed in London for the purpose of operating a steam hammer. The boiler is 8 ft. long by 3 ft. 6 in. in diameter, and has five tubes each of 6 in. bore. It is fired with coal gas from the town main, and is capable of a steam output of 2,000 lb. per hour. Normally it is found sufficient to work the boiler at about half this output. This boiler furnishes an instance of a case where it is a feasible proposition to use expensive illuminating gas for steam making. The boiler is very adaptable to different conditions of loading, and is readily made to furnish just the amount of steam required to operate the hammer. When steam is wanted, the boiler is fired, and the gas is turned off when the work is finished. These and other savings go to make the boiler very economical even when burning expensive fuel.

Construction of Tubes.

In the above case a novel type of tube construction has been employed, as shown in Fig. 3. The tubes are narrowed down at the entrance in the form of a bottle neck. The narrow part serves for the introduction of the fuel mixture at the required speed to prevent back firing while the enlarged part of the tubes is charged with the refractory material. The fire-clay plugs are thus done away with, and the tube itself is kept cool by the surrounding water.

Boiler for Coke-Oven Gas.

Reference might be made to the first Bonecourt boiler installed at the Skin-

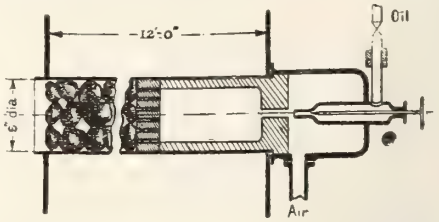


FIG. 5.—ARRANGEMENT FOR THE FLAMELESS COMBUSTION OF LIQUID FUEL.

ningrove Ironworks to use coke-oven gas as fuel. The boiler was 10 ft. in diameter and 4 ft. long, contained 110 tubes of 3-in. bore, and possessed a total heating surface of 316 sq. ft. The results of exhaustive tests showed an evaporation 5,000 lb. of water per hour. The thermal efficiency was 92.7 per cent. when working under 100 lb. pressure, which is

FIG. 6.—SURFACE COMBUSTION BOILER FOR USE OF LIQUID FUEL.

equivalent to evaporating water at the rate of 15.8 lb. per sq. foot of heating surface per hour from and 212 degs. This would have amounted to 20 lb. per sq. ft. without detracting from the effi-efficiency had the boiler been one foot shorter. The extra length had been provided only for increased water and steam space.

The manner of firing is substantially the same as above described. From the front of the boiler a clean view is obtained through all the mixing tubes and creates a very pretty sight. No flame is visible, only a number of bull's eyes of incandescence being seen, all glowing with equal brilliancy. The suction of the fan is regulated by a damper at the rear of the boiler, and the flow of gas is adjusted until the bull's eyes glow with the greatest brilliance. In this way the mixture can be perfectly regulated.

Tube Dimensions.

The first tubes used in these boilers were 3 in. in bore and from 3 to 4 feet long. The tendency now is to increase the diameter to 6 in., which gives increased steaming power, but the heat is greater and the difficulties with the refractory packing increase. By making the granules large enough to stretch across the tube, and by staggering them, the radiation is obtained and the temperature of the refractory material does not raise much above 1,000 deg. C. The power consumed by the fan amounts to about 2½ per cent. of the boiler horsepower.

Several installations have been made of boilers to be fired with ammonia recovery producer gas. These are fitted with thirty-eight tubes of 6 in. diameter, and will evaporate 11,000 lb. of water per hour. In Fig. 4 is shown a boiler constructed to burn blast furnace gas. The combustion takes place in the three large flues, and, after superheating the steam, the products of combustion return through the small tubes. The boiler shown is designed to evaporate 15,000 lb. of water per hour from and at 212 deg. F.

Boilers for Liquid Fuel.

Within the past few months the adaptation of the principles of surface combustion to the use of liquid fuel have been successfully accomplished. The arrangement adopted for this purpose is shown in Fig. 5, and consists of a fire-clay sleeve placed in the entrance of the boiler tube and serves to conserve a certain amount of heat in the chamber thus formed. The rear end of the sleeve is closed by a perforated plate of the same material, and the oil is sprayed into the chamber through a small hole in the other end.

The remainder of the tube is filled with refractory packing, as in gas-fired boilers. The vaporization of the oil takes place in the gasification chamber and in the perforated plate, and enters the combustion zone through the small perforations as a gas. An example of this type of boiler is shown in Fig. 6, which is in successful use in London. The air is supplied under a pressure of 35 inches of water, and the oil flows in by gravity under a 12-ft. head. The boiler is 5 ft. in diameter and 12 ft. long, and contains five 9-inch tubes.

Each fire-clay plug has a sight tube, which gives a good view of the inside of the gasification chamber. The operation of lighting the fire occupies three minutes, and consists in swinging aside the sight tube, inserting some oily waste and turning on the gas and air supplies. In a few moments the chamber becomes red hot, and all that is required is to make the adjustments. The boiler can be brought from a cold condition to 110 pounds steam pressure in 50 minutes.

The steam production can be accurately regulated; an efficiency of 92.5 per cent. has been obtained when evaporating at the rate of 25 lb. of water per square foot of heating surface per hour, and very little excess air is required.

Solid Fuel.

There now remains only the field of solid fuel, the largest field of all, to which to apply this system. This field has already been attacked, and, although not yet completely successful, results have been obtained which give hope of great practical attainments in the very near future. With a small experimental apparatus an evaporation equivalent to 17.8 lb. of water from and at 212 deg. per square foot of heating surface per hour has been obtained, although the amount of air supplied was no more than that required by theory, as shown by an analysis of the flue gases.

TRIBUTE TO OUR FLEET.

THE Archbishop of York, at a Mansion House meeting at York recently, gave his impressions of a visit just paid to the Grand Fleet.

His Grace said: "I am still compelled to speak of that visit with very considerable reticence for obvious reasons, though I hope that the time may come when I may be able to give some record of it. I find it quite impossible to convey any impression of the scenes which I saw or the spirit which I felt, but it is sufficient for me to say that I realized as never before the debt which we here at home owe to these sleepless guards of our island shore. You will realize that these men have been out, not for three minths nor six months, but for twelve months; that during certainly five of these months they suffered hardships which it is difficult for me to describe, spending practically the whole of that time at high speed on wild seas unable to find any secure place of refuge or of protection.

Even now, though happily they are able from time to time to find places of rest, they are all of them living under war conditions, ready to steam out at short notice whenever the challenge comes, under ceaseless strain of manifold difficulties and dangers that we find it very difficult to understand, very near in some cases to their homes, and yet denied the chance even of short leave. There are thousands of men there who, during the whole of these twelve months, have never had a chance of even seeing their wives and children, yet I find there in every part of the fleet, from the Commander-in-Chief downwards, the same spirit of cheerfulness, of readiness, of determination.

It was to me a very great privilege to be allowed to bring to them a message which I hope was real and was sincere, that though our fleet is necessarily out of sight, it is never out of mind. My business was to tell these men that their country was standing by them and was grateful to them, but I am bound to say that having visited them I feel it is more incumbent upon me to bring some word to the people and to ask our fellow-countrymen at home whether we really are standing by them, whether our sacrifices, our determination, and our unity are in any degree comparable to theirs. All I can say is that if the citizens here at home are filled with the same spirit of devotion, comradeship, and unity as fills our guardians of the fleet, then, humanly speaking, we need have little fear of the result."

EVER HEARD OF A THREE-QUARTER TURN BELT?

By H. G. Near.

NOT so many years ago I considered myself pretty much of an expert along nearly all mechanical lines. I had just graduated from college, you see. So, when I was asked by a man who came to me for advice, "Have you ever had any experience with quarter-turn belts?" I assured him with this bluff, "No, but I have had experience with ¾-turn belts."

The man nodded his head and said, "All right, I guess you can handle our job all right. We want you to put in a quarter-turn drive for us." I did it, and the drive was a success, but all the while I was afraid the fellow would ask for further information about that ¾-turn drive, but he didn't say a word.

A ¾-turn drive is about as easily installed as is a quarter-turn. In fact, the difference is not noticeable.

Principles of Laying—Off Cylindrical Intersections---II.

By J. W. Ross

The more or less special nature of the work involved in the making of sheet metal piping has caused many manufacturers to avoid this class of work, with the result that when a job has to be handled, there is frequently considerable unnecessary loss incurred through errors in laying off material. The examples treated by the writer of this article should form a valuable reference to many manufacturers on ordinary as well as special occasions.

INTERSECTIONS OF UNEQUAL DIAMETERS.

IT will be observed that the mitre line is slightly different in the perspective view Fig. 6 than was in the preceding problem.

The side and end elevations are shown in Figs. 7 and 8 respectively. Measure off H G Fig. 7, 2½ inches long. H A is drawn at right angles to H G and is equal in length to the diameter of the large cylinder which is 1½ inches. Draw A F parallel and equal in length to the line H G. Bisect A F at L and raise the perpendicular 10, L, J. Measure L B and L E each equal to ½ inch, thus making the diameter B E of the small cylinder equal to 1 inch. Parallel to 10, J, draw the perpendiculars C B and D E each ¾ inch in length, connect C to D, completing the side elevation outline. The plan view of the small cylinder is drawn above C D and divided into any number of equal spaces. It is desirable in order to facilitate the drawing of the construction lines and the developments, that the numbers of divisions be divisible by four, so that four quarters of the cylinder will be located with two of the points on the centre line vertically and two horizontally as shown in the plan views, Figs. 7 and 8. The number chosen here is 12, the four quarters being then each divided into three equal spaces. Number the points as shown. Project all points so numbered through A F and parallel to the centre line 10 J.

Project the axial line K K Fig. 7 to K¹ Fig. 8. With radius equal to K F Fig. 7, and centre K¹ Fig. 8, draw the circle in Fig. 8 representing the end view of the cylinder A F G H. Fig. 7. Draw the centre line 7 K¹ P Fig. 8 parallel to 10, J Fig. 7. Draw the line 4¹ 10¹ Fig. 8 in line with and equal to CD Fig. 7. The outline of the vertical cylinder is completed by connecting 4¹ to 4² and 10¹ to 10², these lines being parallel to the centre line 7 K¹. Draw the plan view 1, 4, 7, 10, and number in relation to Fig. 7, keeping in mind that the plan view in Fig. 8 is turned one-quarter round to correspond with end view Fig. 8. Project all the points to the section of the cylinder J 7² J Fig. 8. Project these numbered points as 4², 5², 6² etc. Fig. 8 by straight and parallel lines till they intersect similarly numbered vertical lines in Fig. 7. A suitable curve drawn through these points in Fig. 7, defines the mitre line. D C D Fig. 9 equals 3⅛ inches, this being the calculated stretchout of the dia. C D Fig. 7. Divide D C D into 12 equal spaces numbered accordingly. Draw in the perpendiculars equal in length to the perpendiculars of C B J E D Fig. 7. A curve drawn through these located points will define the mitre line or flange line. The rivet line and lap, or seaming allowances being added accordingly. It will be noticed that the contour of the mitre line of this templet is slightly different to that of the templet Fig. 3 for the equal diameter cylinder intersections.

Measure off G, F, G, Fig. 10 equal to the stretchout of the cylinder J, 7², J, P, Fig. 8 of which P 7² Fig. 8 or F G Fig. 7 is the diameter. This equals 1½ inches multiplied by 3.14 equals 4.71 or nearly 4¾ inches. Erect the perpendiculars G H, G H. Fig. 10 at right angles to G G, and equal in length to H G Fig. 7. Connect H to H which will be parallel and equal in length to G G.

Bisect G G at F and erect the perpendicular F, A. Measure 7°, 6°, 6°, 5° 5°, 4°, etc., Fig. 10 equal to the length measured along the curve of 7², 6², 6², 5², 5², 4², etc. Fig. 8. Erect vertical lines on these points as 4°, 4°, 5°, 3°, 6°, 2°, etc. Fig. 10. Bisect H G at J and drawn in the line J J.

Mark the intersection of line J J with line 1° 7°, with the letter L. Locate M and N in a similar manner. Now lay off the distances L, 1², L, 7², M, 12², M, 8², etc. Fig. 7 in their respective positions in Fig. 10. Draw in the curve defining the opening Fig. 10. Draw in the rivet line and space off the rivets. Space off the rivets at H G and add on the laps. This completes the templet.

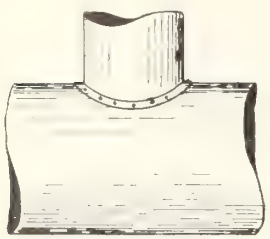


FIG. 6.

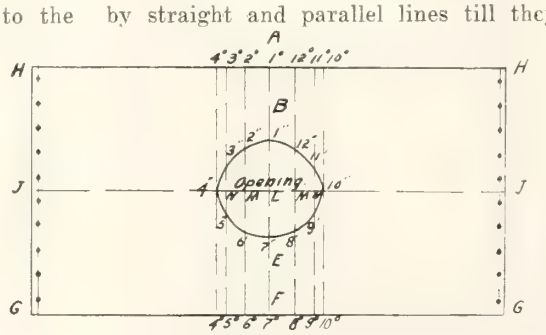


FIG. 10.

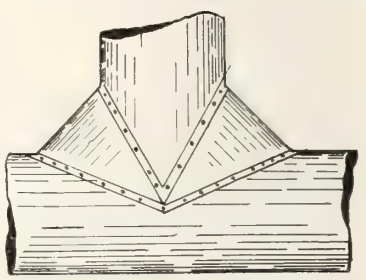


FIG. 11.

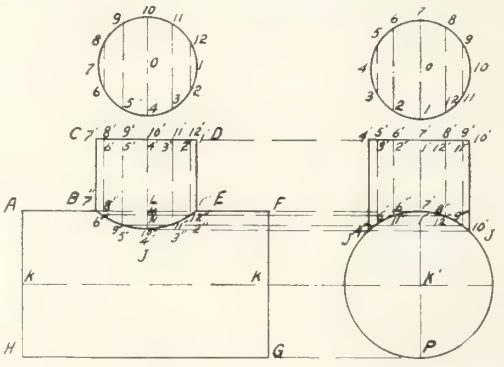


FIG. 7.

FIG. 8.

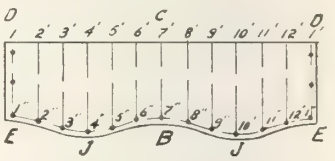


FIG. 9

Reinforced Tee.

The perspective view Fig. 11 illustrates a tee pipe reinforced by a shoulder collar, to resist vibratory strains, etc.

*Note: The reference letters and numerals in the text, i.e., G², 7², etc., correspond with those of the illustrations indicated as G", 7", etc.

Fig. 12 shows the side elevation, while the end elevation is shown by Fig. 13. To construct these views, measure off C D Fig. 12 equal to 3 inches, and A C and D B equal to the diameter of the cylinder—drawn at right angles to C D, and equal to 1 inch in length. Connect A B which is parallel to C D. Bisect A B at L and draw the perpendicular 10, J. Measure of L, 10^1, equal to 1 inch. At right angles to this line, through the point 10^1, measure off 10^1, 7^1, and 10^1, 1^1, each equal to ½ inch, making the diameter 7^1 1^1 of the vertical cylinder equal to 1 inch. Draw the lines 7^1 R and 1^1 R parallel to the centre line 10, J. Mark R, 1^0, R 1^2, R 7^2 and R 7^3 each equal to ½ inch. Connect the point 1^2, 1^3, and 7^2, 7^3. With centre O and radius equal to 4^1, 7^1, construct the plan view 1, 4, 7, 10, as seen through E F. Divide into 12 equal spaces, number and project the points down through E F. Number these also in relation to their position. Now construct the end elevation, Fig. 13, Bisect B D at K Fig. 12. Draw the line K Fig. 12 to K^1 Fig. 13 parallel to A B and C D Fig. 12. With K^1 Fig. 13 as centre and radius K B or K D Fig. 12, describe the circle P, 4^0, 1^0, 10^0. Draw the centre line K^1, 7, Fig. 13 parallel to the centre line 10, J, Fig. 12. Project the line E F Fig. 12 over to 4^1, 7^1, 10^1 Fig. 13. Draw 4^1, 4^0, and 10^1 10^0 parallel to the centre line K^1, 7, tangent to the circle 4^0, 1^0, 10^0, P^0, locating the points 4^0 and 10^0 on the line K K^1. With centre O Fig. 13 describe circle 1, 4, 7, 10, with a diameter equal to the diameter 4^1 10^1 of vertical cylinder. Divide this plan view into the same number of equal parts as the plan view Fig. 12. As this view Fig. 13 shows a quarter turn of the view in Fig. 12, the point 1 will commence on the centre line 7 K^1, the remaining points being numbered in their consecutive order in relation to the position of point 1. Project all these points down to the circle P, 4^0, 1^0, 10^0. Number their intersection accordingly. Project the points 4^0, 10^0, Fig. 13 over to their vertical projection in Fig. 12 thus locating the points 10^0, 4^0 at J, Fig. 12. Connect point J by straight lines with the points J, 1^2, J, 1^0, and J, 7^3, J, 7^2. These lines will define the mitre lines of the several pieces to be developed. From the points 1^0, 2^0, 3^0, 4^0, 5^0, etc., in Fig. 13, project over to the mitre lines 4^0 7^3, and 4^0 1^0, Fig. 12, locating points 1^0, 2^0, 3^0, 4^0, etc. Note where the vertical projectors intersect the mitre line 7^2, 10^2, and 10^2, 1^2. Number these points in respect to their vertical projectors. connect the points 2^2 to 2^0, 3^2 to 3^0, 6^3 to 6^3, 5^2 to 5^3, these lines being parallel to the lines 1^2, 1^0 and 7^2, 7^3. These points may be projected over to Fig. 13 to show the side elevation of the collar, but this is not essential for the development of any of the patterns. In fact the whole of the side elevation view need not have been drawn.

In this case it was done to demonstrate the method of solving the problem. A half section view drawn in the diameter

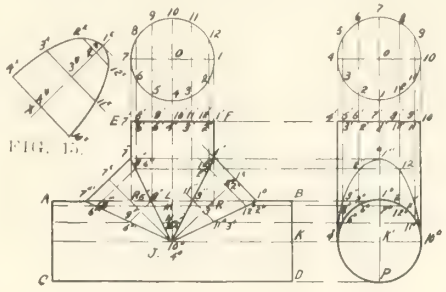


FIG. 12. FIG. 13.

B D, would have given all the information required. If there is any doubt in the minds of the readers regarding the construction it would be better to draw both views thus being enabled to grasp

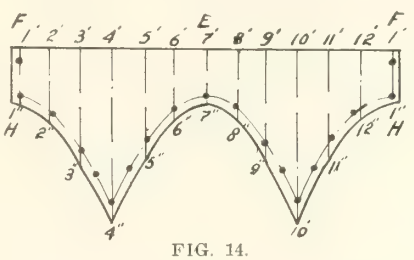


FIG. 14.

the subject more thoroughly. Further advancement in the practice of these problems, would necessitate more or less construction lines according to the class and character of the work. Fig. 14

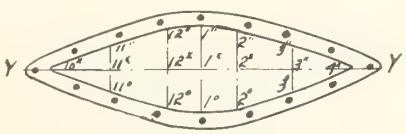


FIG. 16.

shows the templet for the vertical piece in Fig. 12.

Calculate the stretchout of E F Fig. 12, and lay this out on the straight line F E F, Fig. 14. This length equals 1

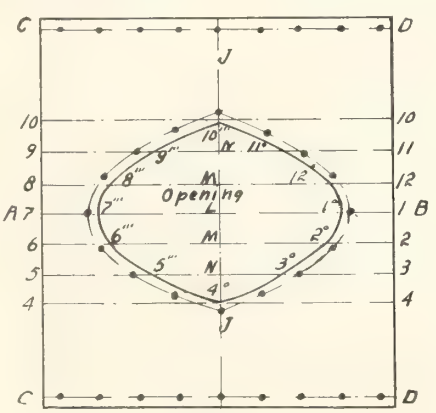


FIG. 17.

× 3.14 or nearly 3⅛ inches. Divide F E F into 12 equal divisions. Through these points draw perpendiculars and number them according to the divisions and numbers of the plan view in Fig. 12. Take the distance 1^1, 1^2, and 7^1, 7^2, and transfer over to 1^1, 1^2 and 7^1, 7^2, Fig. 14. Set the dividers to the distances 2^1, 2^2, 3^1, 3^2, 4^1, 4^2, etc. Fig. 12 and transfer all these distances over to their respective locations in Fig. 14. Draw in an even curve through these points thus defining the mitre line. The connecting flanges being on the collars or gores, the rivet line instead of being added on to the mitre line, Fig. 14, will have to be drawn back towards the line F E F, to a distance suitable so that the mitre line will define the lap. Add the laps for the vertical seams at E H, F H. Then Fig. 14 will show the complete templet for vertical piece as shown in Fig. 12.

To develop the horizontal course Fig. 12, calculate the stretchout of the cylinder of which B D is the diameter. Measure this stretchout which equals 3⅛ inches along the line C A C Fig. 17. Draw D B D parallel and equal to C A C, and make D C, the distance apart equal to the length of the cylinder D C Fig. 12. The line D C is drawn at right angles to C A C. Bisect C A C to locate A. Raise the perpendicular A B to the line D B D. Measure off the distances 7 to 6, 6 to 5 and 5 to 4, etc. Fig. 17, equal to the distances 7^0 to 6^0, 6^0 to 5^0, 5^0 to 4^0, etc. Fig. 13 measured along the curve. Erect perpendiculars through these points, parallel to the line A B. Now take the distances L, 1^0, and L 7^3, Fig. 12, transfer this over to L, 1^0, and L, 7^3, Fig. 17. Similarly transfer the distances M, 6^3, M, 2^0, N, 5^3, N 3^0, etc., Fig. 12 over to their corresponding numbers in Fig. 17. Draw in the curve to define the mitre line which is also the opening. Rivet line being afterwards drawn in according to the laps of the gore. To develop the gore it is necessary to show an end view of the centre gore line 1^x 4^0, Fig. 12.

To construct this section, draw the line $X1^x$, Fig. 15 parallel to the line 4^0 1^x Fig. 12. Transfer the distances 1^x, 2^x, 2^x, 3^x, 3^x, 4^0. Fig. 12 to the distances 1^x, 2^y, 2^y, 3^y, 3^y, 4^y. Fig. 15 . It will be observed that the distance through the points 2^2, 12^2, is equal to the distance through the points 2^1 12^1, which is shown in the plan view 2 to 12 measured along the projector, Fig. 12. As both the intersecting cylinders are equal, the distance 12^0, 2^0, as shown by 2^0, 12^0 in Fig. 13 is equal to 2, 12, Fig. 12. Take this distance and place half at each side of the point 2^y along the line drawn at right angles to $X1^x$, thus locating the points 2^x and 12^x Fig. 15. Make 3^x 3^y 11^x Fig. 15 equal to the straight line distance 3, 11, in plan view Fig. 12, thus defining the section distance through the points 3^2, 11^2, and 3^0, 11^0 Fig. 12. Similarly transfer the distance 4, 0, 10, Fig. 12 to 4^x, Y^x, 10^x, Fig. 15. A fair curve drawn these points represents the sec-

tion shown through the straight line 4° 1^x in Fig. 12. The stretchout of this curve is laid out on the line Y Y Fig. 16. It is divided up into the same distances as on the curve Fig. 15. Draw lines at right angles through these points.

Take the distances 1^x, 1^2, and 1^x, 1^0 Fig. 12, and place this distance to locate the points 1^2 and 1^0 on the line 1^2, 1^x, 1^0 Fig. 16. Again transfer the distances 2^x, 2^2, 2^x, 12^2, 2^x, 2^0, and 2^x, 12^0, Fig. 12 over to their similarly numbered positions in Fig. 16. Transfer the remaining measurements over to Fig. 16. Through these points draw a fair curve. This curve will be the mitre line and in this case also the flange line. Add on the rivet line and laps. Fig. 16 shows the complete templet for either of the two gores.

EXPLOSIONS IN AMMONIA REFRIGERATING PLANTS.

SOME interesting investigations have recently been carried out in connection with explosions that have occurred in refrigerating plants in which ammonia was employed as the refrigerant.

In the first case the explosion was ascribed to the decomposition of ammonia in the compresser cylinder and the penetration of the gases into the engine room. In the subsequent inquiry, tests revealed the fact that a mixture of air with from 16.5 to 26.8 per cent. by volume of ammonia violently exploded when ignited by an electric spark, but that with the ammonia content above or below these limits, no explosion took place.

In another case an ammonia compressor was started with the exit valve in the pressure piping closed, and as a result the cylinder was blown up by the increasing pressure. Immediately afterwards the entire engine room, which was lighted by gas, was enveloped in a sheet of flame. According to the opinion of the investigator, this accident was due not to the combustion of an ammonia and air mixture, but to the ignition of hydrogen, which formed in the engine through the decomposition of ammonia, which decomposition, in its turn, was due to the rise of pressure and temperature of the ammonia caused by starting the compressor with a closed pressure valve. That such decomposition does take place was shown by experiments carried out by Dr. Molar, who has found in three instances a high content of free hydrogen and nitrogen in experimental compressors.

Refrigerating engineers are, however, interested principally in the question whether conditions such as have been shown by these investigations into the explosibility of ammonia and air mixtures, can actually occur in ordinary practice, as it seems extremely unlikely that 16 to 20 per cent. by volume of ammonia can mix with the air except under abnormal conditions. It is also desirable for practical purposes to carry out further theoretical and experimental investigations to ascertain whether decomposition of ammonia under pressure actually takes place, and if so, to determine the best means to prevent it.—Current Engineering.

CARE OF THREADING DIES AND PIPE CUTTING TOOLS.

By P. W. Blair.

OWING to the universal use of dies for the cutting of screw threads on pipes and rods they should receive far more and better attention than is commonly accorded them.

The proper care of the dies and lubrication of same when in use is one of the greatest factors of economy that has to do with their use, and the cutting of screw threads has become one of the most important parts of nearly every line of manufacture of metal products.

In some cases the greatest limits of accuracy are required in the production of threaded parts and it is often remarked by users of stocks and dies, "How is it that I cannot cut so accurate and smooth threads as are on some of the fittings or bolts I have just purchased?"

The whole secret lies in the proper care they take of their tools and the lubricant used. As an illustration, a screw thread may be satisfactory if the parts merely have spiral marks which can be forced into a tapped hole and once in place it is out of sight and may never be discovered, consequently in some instances almost any kind of a thread will pass.

There are, of course, all sorts and conditions, but it seldom requires as much time to produce a perfect thread as it does the other kind, and the good thread can be produced with far less wear and tear on the tools.

If a man becomes sick he usually calls a physician and has his trouble diagnosed and suitable remedies applied. He rarely ever applies the same methods to his business. If a tool goes wrong and does not operate satisfactory he does not spend much time trying to discover the cause of the trouble. If the trouble cannot be removed by the first application of his "remedies." the tool in many cases is condemned as being no good anyway, and he may also have something to say to the maker of such a tool.

In applying a lubricant for the cutting of pipe, bolt and other screw threads, similar results may be arrived at. Some users seem to thing that any kind of a lubricant can be used; consequently an oil of some kind is used but seldom with proper regard, if any, as to whether the oil is suitable for the purpose. One of the most desirable features of screw cutting is to obtain the greatest quantity and quality of the work with the least wear and tear upon the dies.

It does not follow that because you have been using a poor grade of oil with fairly good results, that the same will be obtained when a new shipment of pipes or rods requires threading. The quality of the stock may vary to such an extent that a different grade of lubricant is almost necessary.

Many users of thread cutting dies may still maintain that a tool that will cut a good thread with one grade of oil should give satisfaction used with any oil. Not only should suitable lubricants be used for various grades of metals but also in the cutting of different metals.

Many large manufacturers carry quite a number of different oils and lubricants, and are still experimenting to obtain better results.

All stocks and dies when not in use should be kept in a suitable place and thoroughly cleaned of foreign substances, so that when they are again required they shall be in good condition.

TURBINE DESIGN.

THE principles governing the designs of small and large turbines are quite different. Formerly small turbines were installed to operate non-condensing, the exhaust being used in feed heaters. The highest commercial efficiency of small turbines is about 40 per cent.

In the last two years a demand has arisen for small condensing turbines of high efficiency, and to meet this the Terry Steam Turbine Co. has designed a new turbine. The casing is divided horizontally. The high-pressure wheel, as fitted in the original machine, has been superseded by a two-row multi-velocity wheel running at high peripheral speed. After leaving this, the steam passes round the casing of the low-pressure wheels, which it enters at the further end, so that it flows in the reverse direction towards the exhaust adjacent to the high-pressure part.

The return flow turbine section is designed to have 2 lb. to 5 lb. pressure above atmosphere in the first stage. With steam pressure about 150 lb., allowing two impulses, the peripheral velocity of the buckets must be 636 ft. per second for best efficiency. At 3,600 revolutions per minute the pitch diameter required is 40½ in.

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NOTES ON BEARINGS.

By Armley Leeds.

THE design of bearings of all kinds is a most important problem connected with machine construction. A journal should be designed of such a size and form that it will run cool, and with practically no wear. Heat and wear are the results of friction; therefore we must define friction. Friction is the force acting between two bodies at their surface of contact when being pressed together, and which operates to prevent their sliding upon each other.

Bearings operating under ordinary working conditions warm up until the heat radiated equals the heat generated. They will remain at that temperature, provided there is no change in lubrication, load or speed.

Suitable Oils Necessary.

The pressure which any bearing will stand without seizing depends largely on the temperature, velocity of rubbing, and quality and description of lubricant in use. The lower the temperature the greater the pressure, and the higher the velocity of rubbing the less the pressure. This is due to the fact that oils become thinner and more free flowing as higher temperatures are reached, and consequently more easily squeezed out of the bearing.

A very light oil is liable to be squeezed out at a pressure as low as 50 or 60 lbs. per square inch, whilst a heavy cylinder oil will possibly stand a pressure of 1,000 lbs. per sq. in. The advantage of selecting suitable oils is, therefore, apparent. When a load is unvarying in amount and direction, the oil film is easily broken, but in cases where the load is variable in amount and direction, as in railway car journals and crank pins, the oil film is much more durable.

It has been ascertained that the lubricant in railway car journals, where the force varies continually in amount and direction, will stand twice the amount of pressure of the steady fly wheel journal, and in a crank pin, where the load reverses every revolution, the film will withstand three times that of the steady fly wheel pressure.

A bearing may give poor satisfaction, because it is too long, as well as because it is too short. Almost every bearing is in the condition of a loaded beam, and, therefore, it has some deflection. We will take the case of an overhung crank pin, in order to examine the phenomena occurring in a bearing under these circumstances.

When the engine is first run, both the pin and bushing are truly round and cylindrical. As the pin deflects under the load, the pressure becomes greater on the side toward the crank web, breaking down the oil film at that point, and causing heat. After a while the bushing becomes worn to an increased diameter at the side toward the crank, in the manner shown in Fig. 1. This is, of course, an exaggerated idea of the conditions of affairs in the crank pin bushing under load.

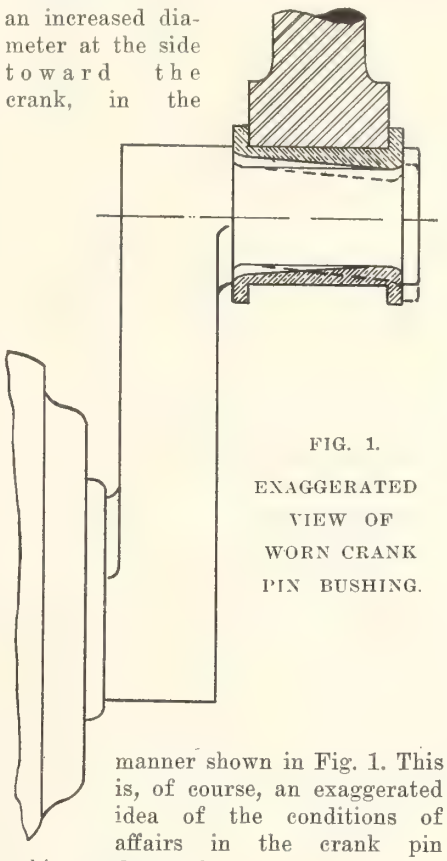


FIG. 1. EXAGGERATED VIEW OF WORN CRANK PIN BUSHING.

Requirements for Success.

For successful working, the bushing and pin must be accurately machined, and may, therefore, vary within narrow limits. The bushing must be a trifle larger than the pin. Should the pin be too large, the oil film will be too thin and easily ruptured. On the other hand, should the pin be too small the bearing surface becomes concentrated at a line, and the greater unit pressure at that part ruptures the film.

This is exactly what happens when the pin is too long. The bushing rapidly wears large at the inner end, and the pressure becomes concentrated along a line as a consequence. The lubricating film then breaks down, and the pin heats and scores. That there is always an element of doubt in regard to bearings is evidenced by the fact that our modern engine builders usually deliver an extra set of bearings with the engine, so that in the event of trouble a new set is at hand.

Workmanship Largely Responsible.

The workman plays a great part in the efficiency of a bearing. Investigation has shown the following to be the main reasons for hot bearings:—

1.—Shrinkage strains set up in the babbitt metal liner by the unequal distribution of the babbitt metal over the shell.

2.—A lack of contact between the babbitt metal lines and the cast iron shell.

3.—The lubricant becomes partially deflected into the wrong place.

4.—Oil grooves cut wrong, because instead of helping the lubricants, they generally drain the oil from where it is most needed. Proper lubrication of bearings involves careful consideration of the materials comprising the journal and its bearings.

Bearings in general use are mainly of cast iron steel, various alloys of bronze and babbitt. As lubricant material is intended to prevent contact between the metallic surfaces, it follows that the greater the pressure of the work per sq. in. of bearing surface, the greater the required viscosity.

Mineral oils semi-fluid at 68 degrees Fahr. may lose half their viscosity at 95 or 105 degrees and become quite mobile at between 122 and 140 degrees.

Heavy-bodied syrup-like liquids at low temperatures offer great resistance to fluidity and the displacement of their particles, and are most suited for slow speeds and heavy pressures.

For light-running shafts a mineral oil of suitable viscosity is desirable.

RECONSTRUCTION OF A FAULTY PIPE LAYOUT.

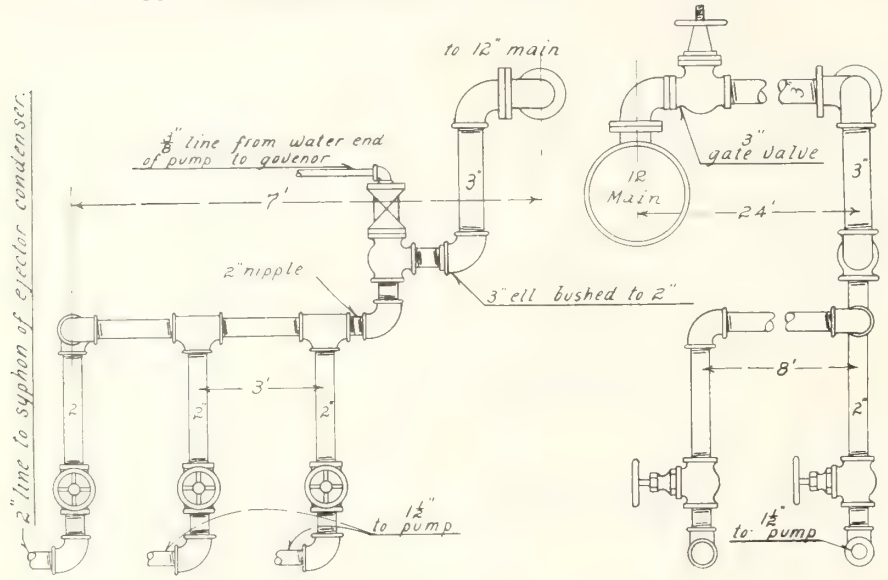
By H. W. Benton.

HEREWITH are sketches showing original layout of pipe line, designed and installed by high-price men, who claimed to "know all about the business," also sketch showing alteration to the original arrangement that makes a very much better and satisfactory job.

The 3 in. line was carried 24 feet to come in line with steam chests of two duplex pumps, each pump steam chest

tapped for 1½ in. pipe; exhaust tapped for 2 in. pipe, a pump governor tapped for 2-in. pipe was supplied with the pumps.

The 3 in. line was fitted up as shown in sketch Fig. 1, with high pressure fittings as far as the governor, then the 3 in. ell was bushed to 2 in. and the governor connected to the 3-in. ell by a short 2-in. nipple; 2-in. lines were run



FRONT VIEW—FIG. 1, OLD LAYOUT—SIDE VIEW.

from the governor as shown, right to the ell at the steam chest and were reduced here to the size required for each pump, by using reducing ells 2 in. to 1½ in., thus each pump, although requiring only a 1½ in. line was piped up with a 2-in. line except the last nipple; that being 1½ in.

The sketch also shows a third 2 in. line taken from the discharge side of the 2 in. governor; this line goes to an ejector condenser, and supplies steam for priming the condenser in starting. When this line is in use it is almost the same as a free open end on the 2 in. line, the condenser uses a large quantity of steam for a few minutes for priming then the line is shut off.

This line is used only when starting up the condenser daily.

The defects were:—

Why use larger size pipe and fittings than required?

Why carry steam twice over the same distances?

Why try to use a pump governor for two separate duties at the same time.

As a result of the bad connections it should be plain that when the pump was operating and controlled by the governor, only sufficient steam passed the governor to drive the pump at a speed to deliver sufficient water to maintain the pressure for which the governor was set:

Now, opening the 2 in. line to the ejector condenser, took all this supply of steam with the result that the pump almost stopped, the water pressure became lower and the governor opened until sufficient steam passed to run the the pump at the required speed as before; but the supply to the ejector was too small and hence the priming of the condenser was a doubtful number: To get by this, the pump was stopped until the water pressure was all down, then the ⅜ in. line to governor was shut off, and the pump started again, regulated by the throttle; thus the governor remained full open, and we could then get sufficient steam for priming the ejector condenser.

This method got over the difficulty, but was not good practice; so the lines were altered as shown by the sketch Fig. 2, so that the 3 in. line was cut at a point in line with the ejector condenser, a 3 in. x 2 in. x 2 in. tee fitted in with a 2-in. short nipple taken out of top of the tee with ell nipple and valve as shown, this continued over to ejector condenser direct, as shown. The 3 in. outlet of tee was reduced to 2 in. by the use of an eccentric, reducing coupling, so as to have bottom of pipe line straight, with no pockets, and a 2 in. line caried direct to pump governor as shown, and from the governor each pump was supplied with a 1½ in. line taken from the 2 in. outlet of governor.

Thus we have:

Steam direct to ejector condenser.

Steam direct to pump governor and pumps.

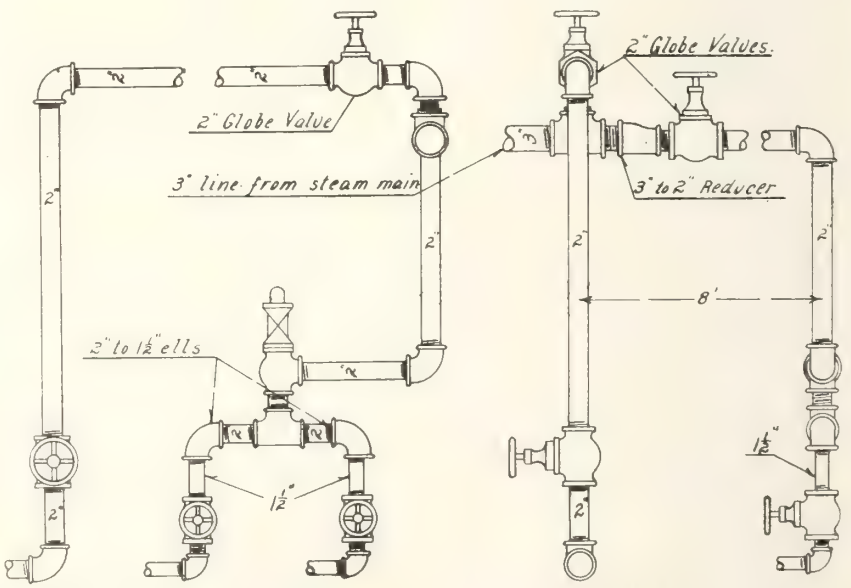
No carrying steam twice over the same distance.

Starting the ejector condenser does not affect the duplex pumps.

Original layout:— Two 1½-in. and one 2 in. lines from a 2 in. supply line.

New layout:—Two 1½ in. and one 2 in. lines from a 3 in. supply line.

The job has a workman like appearance and gives perfectly satisfactory service.



FRONT VIEW—FIG. 2, NEW LAYOUT—SIDE VIEW.

HOW I FELT NEAR A DANGEROUS BOILER.

By W. F. S.

I HAD a sort of sneaking suspicion that the boiler was going to blow up. Chris, the fireman, had allowed the water to go down out of sight in the water-glass and below the gauge cocks. He said he hadn't seen water for an hour, and, growing frightened, he came to me for succor.

My remedy was to draw the fire and shut down the plant, which we did right hastily.

While performing this operation I moved about as nimbly as Chas. Chaplin, I'll wager. Was on my tip-toes most of the time, my idea being that if she blew up I wanted to go up with her as easily as possible. You always feel that there will be less concussion when on tip-toe.

I suppose the feeling of the soldier is much the same when he sees enormous

cannon staring him in the face, and is told that he must charge against them. Hence, I often wonder if soldiers run on their toes. They all must be possessed with the maybe-it-will-happen, and maybe-it-will-not feeling.

After all is over the joy of living is intensified for a few moments; but soon the **big** boss comes along, and what he says sort of spoils the story. I shall therefore close. However, the feeling is unique.

THE MIRROR OF PRACTICE.

By N. G. Near.

YOUR face is dirty. Somebody has told you that it is dirty and you half believe it, but anyway, to convince yourself you look into a mirror and there, sure enough, you see the image of the dirt. Now, what do you do to remove the dirt? Do you wash and polish the mirror? Doing that would only make the presence of the dirt more evident. You can't wash your image and get rid of the dirt. You must wash your face. It is always best to apply the preventive at the source. No matter what you do to the effect, the cause remains unaltered.

In power plant practice, therefore, you can chip scale until doomsday, and it will keep right on forming in the boilers. To keep it out, the water must be treated, not the scale.

Black smoke is pouring out of your stacks. You don't make it white by adding smoke of a different color. You stop the smoke by burning the coal properly.

Your bearings run hot all the time. It would be foolish to keep on re-babbitting without applying oil.

The engine knocks or the turbine rattles. You don't build a muffler around the engine to stop the noise. You stop the noise at the source.

When things go wrong in general, therefore, don't blame the things themselves. Don't always blame the owner, the manager or the superintendent. Maybe **you** are the source yourself.

The image you see in the mirror of practice may be a reflection of yourself, so cleanse yourself.

MAKE STEAM PIPES A TRIFLE SHORT.

By N. Y. C.

A METHOD for dimensioning lengths of steam pipes that may be removed easily in case repairs are needed is now being used by an Eastern designer holding a responsible position with a well-known engineering company.

Usually, where a straight steam pipe line is laid in an average boiler room, little if any allowance is made for pipe expansion when under steam. The expansion is permitted to take care of itself which often is the cause of creating dangerous stresses in the pipes and auxiliary connections.

To overcome these stresses in places where bends are to be avoided as much as possible, this designer makes the pipe initially too short—about 1-10 inch for every ten feet, or one inch per hundred feet. The longitudinal stresses are therefore in the pipe when cold—in tension. And should it be desired to take a length out, a bolted flange-pipe may be dropped out easily.

When under steam, the shortage is taken up by expansion and it is computed that there are no longitudinal stresses in the pipe whatever. This is as it should be for insurance of safety.

LACHINE CANAL RETURNS.

BECAUSE 35 lake freighters with a tonnage of 44,964 tons have passed this season into the ocean and coasting services in search of more profitable charters, the returns of the Lachine Canal for July are far below those for the same month last year. It is expected that the 35 steamers now out of the lakes will return in time for the eastward movement of the Western grain, and in that case the later months of this season should show increases.

In grain the only increase is in rye, 23,135 bushels of that having come down in July this year, whereas none came last year. Wheat, however, came through the canal 5,891,110 bushels short of the 7,763,777 bushels which came through last year. Oats were somewhat better, with a decrease of 126,199 bushels from the total of 1,074,351 bushels for July, 1914. Barley fell 554,394 bushels below the 946,300 bushel total of last year for the same month. Flaxseed was 132,725 bushels less than the total for July last year, 155,725 bushels. The total grain passing through in July this year was 3,258,860 bushels, as against 9,940,153 bushels in July, 1914, a decrease of 6,681,293 bushels, and the total grain which came through the canal to the end of July was 20,913,456 bushels, just 12,571,127 under the total for the same three months in 1914.

Coal, however, shows an increase in the total amount reaching Montreal, there being 190,255 tons this year for July as against 186,014 tons last year for July, or 4,241 tons more.

Flour shows a sweeping decrease, only 1,400 sacks having come down this year as against 74,000 sacks last year. Comparisons of July for other produce shows as follows: Eggs in 1914, 3,221 cases as against 2,270 cases in July, 1915; packages of butter 1,220 in July, 1914, while only 1,049 this year; boxes of cheese in July of last year, 47,107 as against 43,344 last month.

There were 1,143 trips of vessels last month, 429 under July, 1914. The tonnage operated last month was 593,509, as against 842,087 for the same period last year. The pasengers carried through the canal and down the rapids were 12,162 less than the 34,818 total last year in July. The cargo tonnage last month was 452,033, as compared with 715,628 in July, 1914. The trips light this year however, were 157 less than in 1914, when there were 536 trips light by steamers and sailing vessels.

NATIONALITY OF VESSELS SUNK THROUGH THE WAR.

THE number and tonnage of vessels belonging to various countries sunk by warships or by mines during 1914 are as follows:—

	No.	Tonnage
British	101	229,179
French	5	13,097
Russian	7	8,266
German	13	67,641
Austro-Hungarian	4	6,289
Norwegian	8	11,902
Swedish	8	9,875
Danish	7	11,140
Dutch	5	11,571

Percentage of Losses.

The return has been prepared in such manner as to enable a comparison to be made between the percentage of loss suffered by each of the principal merchant navies of the world. These percentages include war losses. While the United Kingdom has lost 2.2 per cent. of the tonnage and 2.43 per cent. of the vessels owned, the "neutral" countries mentioned above have lost 2.37 per cent. of the tonnage, and 2.62 per cent. of the vessels owned by them.

Six Months of German Blockade.

The Admiralty have furnished complete and detailed information as to the results of the so-called blockade, and these details are tabulated thus:—

Total number of sailings and arrivals	31,385
British merchant ships sunk	98
Percentage of loss	0.31
Officers and men lost	505
Neutral ships sunk	95

Every ship sunk is insured and the cost is represented in the freight—which the community eventually pays—and the loss is thus made good to the shipowner. Shipping is one of the prosperous industries at the present time in Great Britain. Ships are at a premium. Those that are still afloat are worth about twice what they were before the war. Those that are sunk are paid for by insurance.

The shelter-deck cargo steamer with cruiser stern to be built by the Fore River Shipbuilding Corporation for the Luckenbach Steamship Co., New York, will be driven by Curtis turbines with reduction gear. This is said to be the first time this system has been tried in a merchant vessel in America.

Dominion Wreck Commission Investigations

Following the proceedings of a vessel stranding or collision inquiry is fascinating alike to the mariner and landsman. Much food for thought is always available, and in not a few instances it seems well nigh impossible to reconcile our conception of disaster prevention achievement when confronted with a detailed recital of the circumstances which contribute to many marine tragedies.

S.S. "HENRY B. HALL" STRANDING.

A FORMAL investigation was held in the Wreck Commissioner's Court, Montreal, on July 23 and 24, 1915, before Captain L. A. Demers, F.R.S.A., F.R.A.S., Dominion Wreck Commissioner, assisted by Captain Francis Nash and Captain J. C. Cain, acting as nautical assessors, into the causes which led to the grounding of the s.s. Henry B. Hall at a place about one and a half miles south-east of the Stone Pillars, in the River St. Lawrence, at about eleven o'clock on the evening of June 10, 1915.

Master's Evidence.

The first witness, Captain David H. Kiah, master of the Henry B. Hall, stated that the vessel was built of oak, having a single screw, with compound engines, carrying a crew of 17 all told, including two duly certificated officers, possessing American licenses; that she was registered in the United States, being 962 tons net and 1,152 tons gross, drawing 15 feet aft and 14 feet forward when loaded, and capable of a speed of nine miles when in that trim; that at the time of leaving Quebec a licensed tour de role pilot—Lucien Lachance—was engaged to pilot the vessel to St. Simeon and back to Quebec. Being instructed by his agents that the pilot was taking charge, he accordingly left the navigation of the ship entirely in the hands of the latter. He and the other officers were practically strangers in these waters, the ship being chartered for the season to carry pulp from the Saguenay to Ogdensburg.

On the night in question the weather was calm, but slightly smoky, although objects and lights could be seen plainly at a distance of four miles. Carrying the impression that the pilot had full charge, he felt relieved of all responsibility and remained in his room, or at least he was there when the casualty occurred. He averred that the pilot did not make any inquiries as to the error of the compass, nor did he ask as to any of the peculiarities of the ship. The compass in the pilot house was practically correct; but the one on the bridge was not used, and, therefore, he did not know if any error existed there. The man supposed to be on the look-out was engaged as watchman, and had various other duties whilst on watch. The second officer was on the bridge from 6 p.m. until the grounding.

When he felt the bumping of the vessel on the rocks, he immediately sallied forth to the bridge, and found it was the last of the ebb tide; that the order full speed astern had been given and then countermanded. However, with the rise of the tide the ship floated off, after having been stranded about half an hour. She was apparently uninjured. No observations were taken so as to positively determine the exact position of the spot where she grounded, but soundings were taken.

In reply to the query of the Court as to whether he had any responsibility as master of the ship, Captain Kiah said as he was told the pilot was in charge, he naturally felt that he was not interested in the navigation of his ship in waters in which he was a stranger. He has been sailing on the lakes as master for about ten years. The pilot was then called, but it was found he was still in Quebec.

Second Officer's Evidence.

The second officer, James E. Norman, who holds an American license, and was practically a stranger to these waters, said that the pilot was sober and awake, or apparently so; that the weather conditions were as already stated by the master; that when the ship grounded he stopped the engines, and the captain came on deck. No bearings or observations were taken in order to ascertain where the ship had grounded. In fact, he conveyed the impression that it was none of his business but the pilot's to look after this.

"Lookout Man's" Evidence.

The lookout man, Laflamme, was next examined, and stated that he was engaged as watchman, his duties being to keep a lookout and sound the wells every hour. At the time of the casualty he was on the lookout. The Court adjourned after hearing this witness until the next day to take the evidence of the pilot.

When the Court resumed the taking of evidence on Saturday, the 24th July, the pilot, Lucien Lachance, was called, and offered a reason, which had no value whatever, as to why he did not appear the previous day when summoned by the Court through the superintendent.

Pilot's Evidence.

He averred that he had been piloting for thirty years, and had but one accident before, which was not made the subject of an investigation; that when he left Quebec to pilot the vessel to St. Simeon and back he did not inquire as to the compasses nor the speed of the vessel. After leaving St. Simeon he steered the usual courses, but found the compass half a point in error on some courses, which is in direct contradiction to the master's statement; that there was but little wind, and the ebb tide was in its last stage; that he steered the usual course passing the Stone Pillars; that the weather was smoky; but lights could be seen two or three miles distant; that he saw a red light, supposedly occulting. This after the grounding he concluded was a schooner's red light being shown intermittently, and which he took for the gas buoy that he was supposed to steer for and pass some 50 feet off in order to shape a course to enter Beaujeu Channel.

He did not take a bearing of the Pillars, or any other object then visible to localize himself as to the spot where the mishap occurred; but he supposed it to be on the south shore, half a mile south and east of the Pillars. The ship floated off with the flood tide, after having been half an hour aground.

When asked as to the compass on the bridge, he said he thought there was one there, but was not sure, hence no use was made of it. It being clear, or practically clear weather, he steered by the lights, without regard to courses. He stated that the ship's speed was six knots, whilst the master averred that it was nine. This was one of the essential points which he did not consider it necessary to enquire about. No further evidence was taken and the court adjourned sine die.

Finding.

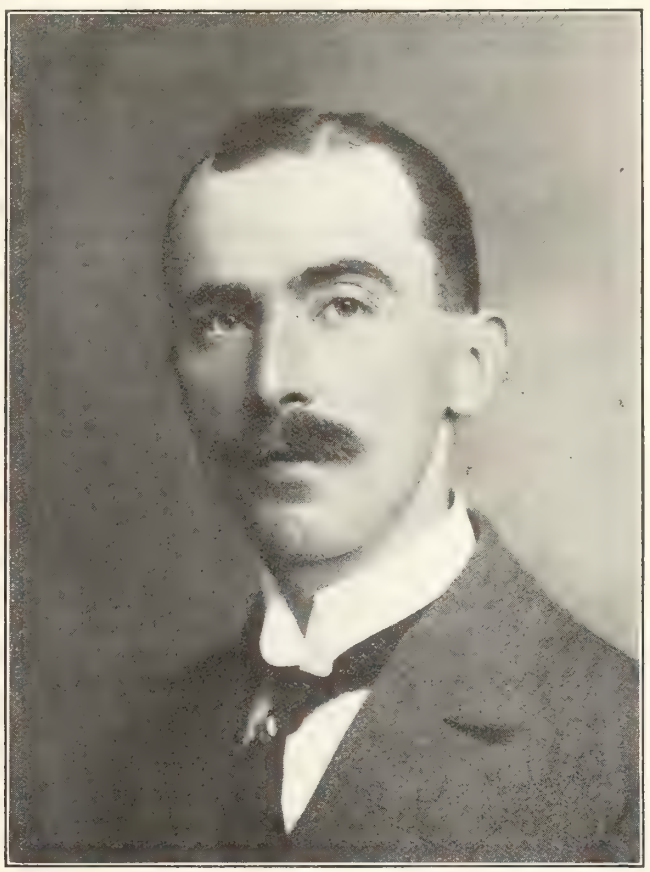
The court, having carefully considered the evidence adduced, cannot help stating that it is absolutely disgusted with the manner in which this vessel was piloted and navigated; the license of Lucien Lachance is, therefore, suspended for one year from August 3, 1915.

With respect to the captain and second officer they being American citizens this court cannot deal with them; but for their benefit, as well as others, we will state that we are simply astounded at the lack of interest shown as to their responsibilities. Knowing that their vessel was chartered for the season to ply in the same waters, one would naturally suppose that they would familiarize themselves somewhat with the names of the lights, courses, etc. If, as Captain Kiah stated, he was informed that the pilot would take charge, some excuse can be found for him, but a degree of blame attached to the officer who made such statement and led the master into a false sense of security.

CANADIAN SHIPBUILDERS

THE Collingwood Shipbuilding Co., Ltd., Collingwood, Ont., of which Mr. John S. Leitch is general manager, is one of the most important shipbuilding, engineering and repair plants in Canada, possessing, as it does, two excellent drydocks, commodious building berths with overhead electric crane equipment, engine and boiler shops, foundry and other customary buildings necessary for an up-to-date establishment of its kind. In addition, work is now being carried on night and day producing shells, the company having installed equipment for the manufacture of both shrapnel and high explosive shells.

Mr. Leitch, who is 35 years of age, has been with the Collingwood Company for over three years, and is responsible to the directors for the management of the entire plant. Under his guidance an interesting variety of vessels, with their propelling machinery, has been successfully produced, including such widely different types as 550-foot bulk freighters, powerful bucket ladder dredges for service in the St. Lawrence ship channel, lighthouse and buoy vessels, hopper barges for the Dominion Government ser-



JOHN S. LEITCH.

vices, passenger vessels, etc. Recently an order for two large bulk oil steamers has been secured. It will therefore be seen that the company is enterprising and progressive.

In addition to new construction, a considerable quantity of repair work is overtaken, the most interesting of the later jobs being the straightening and reconstructing of the large freighter "Howard M. Hanna, Jr.," which came to grief in the memorable gale of November, 1913.

Mr. Leitch, who hails from Portpatrick, in the south of Scotland, gained his technical and practical experience in the three largest British shipbuilding centres, viz., the Clyde, Tyne, and Belfast, having been successively employed by the late firm of Robert Napier & Sons, Glasgow; Swan, Hunter & Wigham Richardson, Neptune Works, Walker-on-Tyne, and Workman, Clark & Co., Ltd., Belfast.

Starting in the shops as an ordinary apprentice, Mr. Leitch has risen rapidly to the highest position in the shipbuilding profession. He resigned from the position of assistant manager with Workman, Clark & Co. in order to take up his appointment in Collingwood

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THE WAR UNIQUE IN OPPORTUNITY.

THE facts that the chairmanship of the British Government Inventions Committee was offered to and has been accepted by no less a personage than Baron Fisher indicate at once the outstanding difference between the present war and those that have preceded it.

Since the days of Napoleon, none of the wars in which Great Britain has been involved have appealed so directly and irresistibly to her people. Many of us here in Canada, who a year ago did not know the difference between shrapnel and lyddite shells are not only now familiar with these missiles in their every detail, but are in addition sufficiently well posted as to converse fluently and confidently on matters military and naval generally.

Do we pause at all to consider these changed conditions? The conduct of wars in the past was almost entirely a Government affair. The training of men, the manufacture of munitions, the procuring of stores, arranging of transport and a myriad other activities connected with campaigning, were all carried out in more or less secrecy by Government Departments; the public meanwhile acquiring their knowledge of what was transpiring through the medium of the newspapers. Information so acquired was, of course somewhat scrappy, and as a result no very keen general interest was aroused.

In the present struggle tremendous issues are at stake, and of necessity our people must not only be conversant with these but so adjust themselves as to secure for our Empire an ultimate and abundant justification reward. To this end the united efforts of our manufacturers are bent towards the production of military commodities. Every little factory with power available feels called upon to assist, all of which plainly indicates that the successful prosecution of the present grim struggle is wholly dependent on the vigorous application of the knowledge acquired in the pursuit of peace time business.

To engineers more than to the members of any other profession this war has brought opportunity, and both in the workshop and office, and in the field we believe this many-sided craft is directing its energies to produce the most effectively helpful results.

Canadian engineers although working several thousand miles away from the storm centre of the war, need not feel that distance detracts from the value of their efforts. It may be of course that some may judge us by the number of shells shipped in a given time, or by some similar numerical production basis, yet it should not be forgotten by even our smallest employer or by our humblest employee that the sum of much indirect effort may even help as much if not surpass that obtainable from a brilliant technical invention of, it may be, restricted application. Various ideas have been adopted by shell makers in performing minor operations, which, had they been proposed with all seriousness in peace time, would possibly have received scant consideration by munition experts.

In making shells in peace time it was required that the inside of the shell be machined all over so as to ensure a uniform thickness of wall, and perfect balance. This was not specified on shells made here, but on many occasions objection was raised to the amount of forging scale on the inside. This could only be removed with difficulty and with much loss of time if attempted with orthodox appliances. A boiler tube cleaner of the centrifugal type when revolved in a suitable fixture successfully overcame the trouble, but wouldn't it have been some shock if a shell maker had informed a munitions expert that a boiler tube cleaner was increasing the output by 30 per cent.

Instances such as these are of frequent occurrence, and the free exchange of ideas between shell makers in Canada and all over the Empire is only one of many indirect efforts, the combined effect of which will not only aid in bringing the war to a desirable termination, but will establish a common bond of manufacturing interest which is certain to have a powerful influence on the recovery and further development of Canada's Commerce when ploughshares and pruning hooks again resume their normal occupations.

MARINE NEWS FROM EVERY SOURCE

Kingston, Ont.—The old steamer Reindeer, which plied between Napanee and Picton until it went ashore some three years ago, has been sold and will be broken up.

"Royal Edward" Sunk.—The C.N.R. steamship Royal Edward on charter to the British Government has been sunk while trooping to the Dardanelles by a German submarine in the Aegean Sea.

Sarnia, Ont.—The steamer Noronic was released from the sandbar at Belle Isle on the morning of August 3. Several tugs and steamers, including the car boat Detroit, were required to pull her free.

"Bengore Head" Casualty. — The steamer Bengore Head was floated on Aug. 12, after being aground since Aug. 1, following a collision with the collier Batiscan in the St. Lawrence. She is now in the Levis drydock for repairs.

St. John, N.B.—Harbor revenues for July show a most satisfactory increase over those of last year, due to the large number of steam and sailing craft that have been loading here for Old Country ports. The receipts during the past month totalled $5,168.85, while for July last year they amounted to $2,827.36.

British Vessel Losses in July.—The monthly statement of the British Board of Trade, issued on August 4, showed that during July 46 British steamships with an aggregate tonnage of 48,712, were sunk by German warships, with a loss of 63 lives; four steamers, whose tonnage totalled 4,705, were sunk by mines, with 19 deaths. German warships also sank 16 sailing vessels, with an aggregate tonnage of 5,747.

Ottawa, Ont.—Tenders will be received until Wednesday, September 1st, 1915, for the manufacture, delivery of, construction and erection complete of sluice pipes, valves, operating machinery and electrical equipment for Swift Rapids Dam, Trent Canal. Plans, specifications and forms of tender can be obtained by application to the chief engineer, Department of Railways and Canals, Ottawa, or to superintending engineer of the Trent Canal, Peterboro, Ont.

Steamer Abandoned.—Efforts to raise the British steamer Desola, which sank in the harbor of St. John's, Nfld. last winter, have been finally abandoned. Divers sent down to examine the condition of the hull found that the sulphuric acid which had leaked from her cargo had so eaten away the plates that it would be impracticable to attempt to float the vessel. The wreck will be destroyed by dynamite. The Desola, which left New York for Plymouth, England, in December, 1914, with a cargo of sulphuric acid in steel drums put into St. John's because of leaks in the drums. After a third of the cargo had been discharged the acid reached the hull, damaged the steam pipes and set the woodwork on fire. Shortly afterwards the steamer sank.

Range Lights Placed at Nottawasaga Mouth.—President Livingstone of the Lake Carriers' Association has been notified by the Canadian Department of Marine and Fisheries that range lights have been established by the Canadian Government at the mouth of the Nottawasaga River, Georgian Bay. Each is fixed white, visible ten miles, and is displayed from a white pole with slatted triangular day-mark, placed apex down. The front light is 30 feet above water and 25 feet above the ground. The rear light is 41 feet above water and 30 feet above the ground, and is 65 yards 136 degrees from the front light. The position of the front light is approximately latitude 44 degrees 32 minutes 6 seconds north, longitude 80 degrees 56 seconds west. The lights will be maintained from June 15 to September 15, each year.

Torpedoed Steamer in Montreal.—A recent arrival in the port of Montreal was the steamer Wayfarer, which was torpedoed by a German submarine in March last, and which attracted general attention because she was one of the largest vessels which had up to that time been torpedoed by a submarine. She is a steel, twinscrew, four-masted steamer, built in 1903 at Belfast, 505 feet long, 58.3 feet in beam and 31.7 feet in depth. It was off the Scilly Islands that the torpedoing occurred, but the vessel was able to make Queenstown four days later. She was on her way to the Dardanelles at the time with troops and horses. She made port with a forty-foot hole in her bow, but was soon repaired.

C.G.S. "De Levis" Sunk.—The Canadian Government steamer De Levis, coming down the St. Lawrence River with over 100 people on board, at 3 a.m. on the morning of August 21, was rammed by the Montreal Harbor Commissioners' tug, Sir Hugh Allan, the former vessel sinking within ten minutes. Luckily no lives were lost. The De Levy was coming back to Three River with 125 laborers working on the Government dredges, who were going home for the week end. There were also six women on board. The vessels crashed deeply into each other, but the Sir Hugh Allan escaped with slight injuries, though the shock was felt by all its occupants. The scores of people on the sunken vessel were soon out of their beds, but only escaped in their night dress, being rescued in the lifeboats of the tug. They were rowed ashore to Three Rivers, where they were given all the attention and care available. The catastrophe is not magnified by loss of life, thanks to the shallow waters where the De Levis went down. She now lies in five feet of water, her hull raised above the water line.

Concrete Scow Experience.—Apropos of experiences with concrete barges on the Panama Canal, it is worth noting that a concrete barge has been in service on the Welland Canal for four and one-half years and during that time has been subjected to severe service. It is used in canal maintenance work and at times riprap in loading has been dropped on its deck from a height of 12 ft. The scow, which was built in November, 1910, is 80 ft. long, of 24 ft. beam and has sides 7 ft. high. The hull is divided into eight compartments by on longitudinal and three cross bulkheads. There are 2 x 2½-ft. openings through the cross bulkheads. The deck, bottom, sides and bulkheads are 2½ in. thick, reinforced in both directions by ¼-in. round rods on 2-in. centres. Beams 6 in. square on bulkhead lines, reinforced with heavier steel, as required, and braced by reinforced-concrete posts, care for the principal stresses. The concrete is a 1:4 mixture, using small gravel.

THE "LEWIS" AUTOMATIC MACHINE GUN.

THE machine guns which the Ontario Government will supply to our overseas forces at a cost of $200,000, might rather be termed rifles. The official name of the weapon is "The Lewis Automatic Machine Gun." It weighs only 25 pounds without its tripod support, which is four and a half pounds in weight. Thus the whole gun may be carried about by one man, and operated by one man, without difficulty. A powerful man may even use the weapon from the shoulder, as though it were an ordinary rifle. One gun can fire 440 rounds per minute, including the time necessary to change magazines, each of which contains 47 rounds. It is in operation in the French and Belgian trenches at the present time, and is somewhat similar to a Hotchkiss automatic rifle employed by the French.

The Lewis gun is designed in such a manner that the only tool necessary to dismantle it completely is an ordinary service cartridge, the point of whose bullet is used to disconnect every portion of the mechanism; and this operation is such a simple matter that the gun can be "knocked down" and any small damaged part replaced, well inside five minutes. The weapon takes the service ammunition, and its range is similar to that of the service rifles. When used on a fixed mount the butt stock may be removed and a "spade handle" substituted.

Constructional Features.

The gun is of very ingenious construction. A detachable magazine loaded with 47 cartridges is attached to a suitable fixing on the barrel near its rear end, the first cartridge being fed from the magazine into the firing chamber by the first forward movement of the firing pin, which is, however, arrested before the striker reaches the cartridge unless the trigger is held back. When the trigger is pressed, the striker, carried forward by the mainspring, explodes the cartridge in position in the firing chamber.

Before the bullet leaves the barrel under the influence of the gas pressure, it uncovers a hole connecting the barrel with a cylinder below and lying parallel with it. A portion of the gas passes into the lower cylinder, driving back the piston, and with it, the rod against the pressure of the mainspring. The movement of the rod recocks the gun, throws out the exploded cartridge case, and during the early stage of its return journey, under the mainspring's influence, transfers a live cartridge from the magazine to the chamber.

If the gunner lets go the tripper the firing ceases, and the gun remains cocked until the trigger is again pressed; if, however, he keeps a continuous pressure on the trigger, the weapon continues to fire until all the cartridges in the magazine are exhausted, the rate of continuous fire being as high as 440 rounds per minute, including the interval occupied by replacing empty magazines with loaded ones.

Dissipating Barrel Heat.

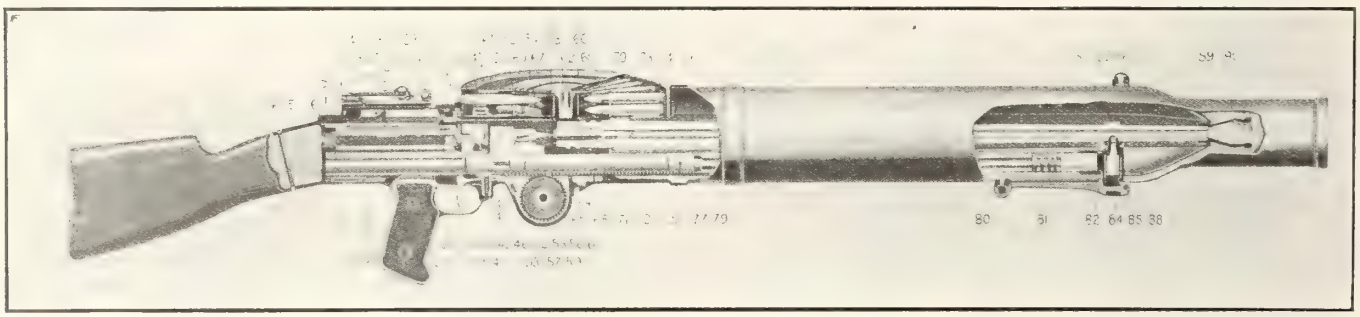
The dissipation of the intense heat developed by the almost continuous combustion of explosive charges in the barrel of the machine gun presents a somewhat difficult problem, and failure to accomplish this efficiently causes the barrel to become red hot and prematurely to explode the incoming cartridge. The barrels of the Lewis and the Hotchkiss guns are both cooled by means of ribs which radiate the heat into the atmosphere, those of the Lewis being placed longitudinally and contained in a steel casing, through which cool air is drawn by the "exhausting" effect of the powder blast in the muzzle end of the casing, in the same way that the air is drawn through the fire-box of a locomotive by the blast of the exhaust steam in the chimney.

Recoil Feature.

The recoil on the Lewis gun is counter-balanced in a very simple and ingenious manner, the gas from the discharge being directed by means of a cone attached to the muzzle of the barrel proper, on to the inner surface of the casing, so that the friction between the gas and the metal casing tends to carry the gun forward with the stream of gas, and so counter-balances the force of the recoil acting in the opposite direction.

The mainspring of the Hotchkiss gun takes the form of an ordinary coil-spring acting in compression situated in the cylinder underneath the barrel; whilst the same unit in the Lewis is a spring of the type used for the mainspring of a watch, but naturally of a much greater power. This spring is coiled up in a circular case attached to the gun just in front of the trigger, in a position sufficiently far from the barrel to be unaffected by the heat, and, consequently, in no danger of losing its temper from overheating. The Hotchkiss mainspring acts directly on the piston rod, which it surrounds; whilst the Lewis is coupled to its rod by a rack and pinion.

The magazine of the Lewis gun is circular in shape, the forty-seven cartridges with which it is loaded lying radially in two layers with their bullets pointing toward the centre.



THE "LEWIS" AUTOMATIC MACHINE GUN

1—Butt plate. 2—Butt plate screws. 3—Butt. 4—Butt tang screw. 5—Butt tang. 6—Feed cover latch. 7—Butt latch, securing butt to receiver. 8—Back sight bed spring. 9—Back sight bed spring screw. 10—Butt latch spring. 11—Back sight bed. 12—Feed cover latch pin. 13—Feed cover. 14—Back sight leaf. 15—Back sight thumb piece. 16—Back sight slide catch. 17—Back sight fine adj. worm. 18—Back sight fine adj. worm axis pin. 19—Back sight slide catch spring. 20—Back sight slide. 22—Firing hand grip. 23—Back sight axis pin washer. 24—Back sight axis pin. 25—Back sight axis washer fixing pin. 26—Receiver. 27—Magazine pawls spring. 30—Trigger. 31—Feed operating stud. 33—Trigger pin. 34—Feed operating arm. 37—Bolt that closes breech and takes shock of discharge. 39—Guard. 40—Cartridge guide spring. 41—Sear spring. 42—Sear. 43—Magazine pan. 46—Gear stop. 47—Striker fixing pin. 48—Gear stop pin. 49—Gear stop spring. 50—Striker. 51—Cartridge spacer. 52—Gear operated by main spring. 53—Main spring casing. 54—Magazine top plate rivets. 55—Main spring which closes breech and returns parts to firing position. 56—Collet pin. 57—Main spring collet. 58—Magazine center. 59—Main spring rivets. 60—Magazine latch spring. 61—Gear casing. 62—Magazine latch. 64—Gear casing side piece. 65—Gear case hinge pin. 66—Feed operating arm latch. 67—Magazine top plate. 68—Receiver lock pin. 69—Cartridge spacer rivets. 70—Interior cartridge separators. 71—Radiator casing rear, locking piece. 72—Rack, actuated by piston and main spring. 73—Radiator casing rear, platform. 74—Radiator casing rear. 75—Piston connecting pin. 76—Barrel. 77—Gas cylinder. 78—Radiator for cooling barrel. 79—Piston operated by gases of exploding cartridge that ejects empty shell and resets firing pin. 80—Regulator key stud. 81—Gas regulator key. 82—Gas chamber. 83—Gas port. 84—Gas regulator. 85—Clamp ring. 86—Fore sight. 87—Clamp ring positioning screw. 88—Clamp ring screw. 89—Barrel mouth piece. 90—Radiator casing front.

CONTEMPORARY WAR ARTICLES

Embracing Information and Data Drawn from a Variety of Sources Relative to and Arising from the Prosecution of this Many-Sided European War

THE YEAR'S WORK AT SEA.

WHEN, in 1804, Nelson had been cruising for fourteen months off Toulon, hoping and praying that the French fleet would come out and give him battle, says the naval correspondent of the Globe, the City of London made the egregious mistake of sending him a vote of thanks for—to quote Southey—"his skill and perseverance in blockading that port so as to prevent the French from putting to sea."

Nelson, already sore because the city had omitted its customary thanks after the destruction of the Danish fleet at Copenhagen, was not slow to seize the advantage which this communication offered him. "I beg to inform your Lordship," he wrote to the Lord Mayor, "that the port of Toulon has never been blockaded by me; quite the reverse. Every opportunity has been offered to the enemy to put to sea, for it is there that we hope to realize the hopes and expectations of our country."

The error of the City Fathers was not a very heinous one, for, after all, there is little difference from the enemy's point of view between remaining in port under compulsion and coming out to destruction; in either case the ocean highways are closed to him and free to his superiors. That was the case of the French and Spanish navies during the 29 months' wait of the British fleet that led up at last to Trafalgar, and it is the case of the German fleet to-day.

Superiority in Guns.

A year of war has passed without any serious attempt on the part of the enemy either to challenge our command of the sea or to diminish the margin of superiority by which we hold it; and as far as the so-called high sea fleet is concerned it is not easy to see what it could have done of greater benefit to its country than to keep safely out of harm's way. We do not know what the measure of Sir John Jellicoe's superiority may be in ships, but it is considerable; and it is enhanced to a great degree by the folly of Krupp commercialism, which bound the German navy down to the 12-inch gun while we were mounting the 13.5 and the 15-inch.

The first year of hostilities has, however, forced upon the notice of the world a factor of far greater importance than ships and guns. The German seaman has proved himself a man not lacking in courage. Whether we take the ships that went down off the Falklands, or the battering which the stranded Emden stood before a seaman swarmed up her mast and tore down the colors that were nailed to it, or the officer of U-18 who chose to sink his ship and himself with her rather than she should fall into our hands—these incidents are evidence of a courage that must compel our respect. At the same time, there is a canker gnawing at the spirit and efficiency of the German fleet that must tell increasingly in our favor as time goes on.

German Sea-Sense.

On August 18 last year the Admiralty reported that there had been "desultory fighting" in the North Sea. What it amounted to we have never been told; but it is the only occasion so far on which British and German forces have been in conflict in those waters without the hostile force being totally destroyed or badly mauled, or else running full pelt for its harbors at the first sight of a British ensign. It is true that in most of these meetings the balance of strength has been on our side—which is but a testimony to the efficiency of our own and the inefficiency of the German staff.

Count Reventlow has told us some pretty tales about the Dogger Bank action of January 24; and this, as it happens, affords us a very useful illustration of the subject of this article. The Blucher, he tells us, "ought not to have been brought into the battle at all." That is obvious to the most casual of arm-chair strategists; but to what degree has the confidence of the German navy in its rulers been increased by this act of sheer, criminal folly? The ex-lieutenant also points out, correctly enough, that the British ships had the advantage in gun calibre; but he surely does not forget that the German people and the German navy have been assured again and again by Von Tirpitz himself that the Krupp 11-in. was better than our 12-in., and their 12-in. at least as good as our 13.5. In this matter, again, surely there must be some doubts arising in the fleet as to the sea-sense of its managers.

It is not necessarily a disgrace to flee before a superior force, though it is not a habit that has been cultivated by our own fleet in this war or any other; but what do the German Puggs (no disrespect) talk about when the day's work is done? Is it about the "raid" on Yarmouth in November, when a squadron of battle and armored cruisers fled so precipitately before a few of our light cruisers (which they could have eaten) that one of them careered into a German mine-field and sank? Is it about the plucky fight which the 22,640-ton Goeben and the 4,480-ton Breslau put up against the mighty Gloucester, whose entire broadside weighs less than a half of a single shell from a Goeben gun? Or is it about the victories that the despised Russians have won in the only two stand-up fights that have so far occurred in the Baltic?

It is possible, no doubt, to feed up the German public with stories about the Tiger and similar "incidents"; but the seaman knows—he was there, and he knows that his government is backing up his poor best with lies. Unless he is in a submarine he knows he has never seen a British warship but to run away from it. He knows that, in four set scraps in the North Sea, eleven German cruisers and torpedo-craft have been sunk at a cost to us of an armed trawler. He knows that it is risking almost certain destruction to venture fifty miles beyond the limits of his mine-fields.

Good Gunnery Means Good Nerves.

Count Reventlow tells us that it has always been manifest that the German ships shoot better than the British, yet one whole squadron bombarded Yarmouth without even hitting the beach, while another fired several concentrated broadsides at a 500-ton destroyer and fled with a casualty list of one killed and eight wounded to its credit. German gunnery is not underrated in the British Navy. It is admittedly good, but it goes to pieces when the other ships—our ships—begin to hit back. This is the natural corollary of the usual roles occupied by our ships and the German.

Good gunnery requires good nerves, and to be in a fleeing ship with no object in view but to get safely home with a sound skin and a whole vessel is not conducive to steady nerves. Stern, close fighting, whenever possible, will always develop and emphasize the difference between our long-service seamen and the pressed three-year men who form the bulk of Germany's naval personnel.

To sum up—The moral ascendancy which our fleet has established in the first year's war is bound to increase as time goes on, for good seamen are not made by constantly shirking action, however much the shirking may be justified on other grounds. Of our own fleet little

need be said. When we repeat Mr. Balfour's trenchant summary that "no fleet could have done more" we have said enough, save only one thing. There is no greater augury for the future than the feelings that are entertained for Sir John Jellicoe by every officer and man under his command. It is doubtful if Nelson himself ever inspired more confidence and affection.

EQUIPMENT FOR AUSTRALIAN NAVAL DOCKYARD.

TENDER forms, specifications and drawings have been received by the Department of Trade and Commerce, Ottawa, from D. H. Ross, Canadian Trade Commission at Melbourne, covering machinery equipment required for the Commonwealth Naval Dockyard, Cockatoo Island, Sydney, N.S.W. Details of the requirements, including closing dates of tenders, are as follows:—

Section A.—Three 1,000 k.w.d.c geared turbine generator sets as per plan, viz., boilers, mechanical stokers, economizers, feed pumps, superheaters, piping and valves, coal and ash conveyor, crane, 1,000 k.w.d.c. geared turbo set, 225 k.w.d.c generator, rotary balancers, main switchboard and cables, condensers.

Section B.—Three 500 k.w. triple expansion reciprocating sets; two 750 k.v.a. mixed pressure exhaust turbine alternators—viz., boilers, mechanical stokers, economizers, feed pumps, superheaters, piping and valves, coal and ash conveyors, crane, 500 k.w. reciprocating sets, 750 k.v.a. mixed pressure turbines, 225 k.w. generator, rotary balancers, switchboard and cables, condensers.

Section C.—Three 500 k.w. triple expansion reciprocating sets; two 750 k.w.d.c. mixed pressure exhaust turbine generators—viz., boilers, mechanical stokers, economizers, feed pumps, superheaters, piping and valves, coal and ash conveyors, crane, 500 k.w.d.c. reciprocating sets, 750 k.w. mixed pressure geared turbines, 225 k.w. generator, rotary balancers, switchboard and cables, condensers.

Section D.—Five 600 k.w.d.c. Diesel engine sets, viz., 600 k.w.d.c. Diesel sets, 225 k.w.d.c. Diesel sets, rotary balancers, switchboard and cables.

Machine Tools for Engineering Department of Dockyard.

Pattern Shop.—Disc grinder.

Plumbers' Shop.—Single head pipe screwing machines, pipe flange face grinder.

Joiners' Shop. — Automatic knife grinding machine, pendulum saw, Perkins or other hand trimmer, planing machine.

Coppersmith Shop.—Pipe screwing machines, pipe bending machine, punching and shearing machine, circular saw, hack saw.

Bolt Shop.—Automatic screwing machines drop hammer, nut facing machine, multiple head tapping machine, hot press nut machine.

Turbine Shop.—(Blading Room).—Packing piece cutting-off machine, blade tipping machine, horizontal multiple-blade drilling machine.

Shipwrights' Shop.— Electric deck planing machine, planing machine, boring machine, steam hammers, steam hammer, steam olivers, forge steam hammer.

Electrical Shop.—3½-inch lathe, 6-inch lathe, pipe-cutting machine, shaping machine, pipe screwing machine, combined wet and dry grinding machine, punching and shearing machine, radial drilling machine, universal milling machine, coil winding machine, armature coil taping machine, vacuum drying and impregnating plant.

Brass Finishers' Shop.—Brass finisher's turret lathe, brass finishers' surfacing and boring lathe, duplex cock turning lathe, screw cutting lathe, grinding machine, high speed shaper, boring and facing machine, horizontal drilling machine, condenser ferrule making machine, double-headed disc grinders, ribbon grinder, automatic screwing machine.

Tenders should be addressed to the Director of Navy Contracts, Navy Office, Melbourne, Australia. The departure of mails, by which tenders can be submitted within the contract time, from San Francisco and Vancouver, are as follows:—From San Francisco, September 28, due at Melbourne October 19; from Vancouver, September 29, due at Melbourne October 23. There is no duty on naval supplies.

Fitting Shop. — Planing machines, slotting machine, double-headed shaping machine, universal miller, high speed sensitive pin drills, high speed boring and surfacing machines, high speed radial drilling machines, variable speed combination turret lathe, variable speed hexagon turret lathe, variable speed gap lathe, hollow spindle friction capstan lathe, variable speed hollow spindle flat turret lathe, double grinder, side disc grinder, band saw.

Tool Shop.—Sliding, surfacing and screw cutting lathes, high class horizontal planing machine, universal milling machine, die sinker, high class shaping machine, radial drill, thread milling machine, grinding machine, hydraulic press, hydraulic vertical plate bending machine, hydraulic riveting machine, hydraulic joggling machine, high speed friction saw, hydraulic portable riveting machine, manhole cutting machine, large hydraulic press, set rolls, multiple spindle drilling machine.

Platers' Shop.—Hydraulic joggling machine, hydraulic manhole punching machine, notching machines, double punching machines with side shears, bulb angle and double bar shear and beam bending machine, plate slitting shears, band saw, plate straightening rolls, horizontal drills, punching and shearing machines, double tool grinders, pneumatic hammer, bevelling machine, hydraulic frame benders, punching and shearing machines, radial countersink drilling machines, bulb angle and double bar shears and beam bending machine, plate slitting shears, horizontal drills, band saw, plate bending rolls, manhole punch, plate joggling machines, plate flanging machine.

Machine Shop.—Turbine boring machine, vertical and horizontal planing machine, horizontal boring, tapping, studding, drilling and milling machine, horizontal drilling, tapping and studding machine, high-speed turbine rotor lathe, shafting lathe, heavy double-ended, heavy duty lathes, high-class lathe, high-speed high-class lathe, high-speed vertical boring mill, vertical turning and boring mill, vertical boring and turning mill, face plate lathe, cylindrical grinding machine, broaching machine, horizontal planing machines, slotting machine, vertical shaping machine, shaping machines, gear generating machine, bevel gear cutting machine, thread milling machine, band saw, vertical grinder, double-headed disc grinder, cylindrical grinder, boring and facing machine, vacuum cleaning plant.

Tenders for the various items close at Melbourne on October 25, 1915.

"MIDLAND QUEEN" TORPEDOED.

THE British steamship Midland Queen, owned by the Canada Steamship Lines, which sailed from Sydney, C.B., July 21 for Glasgow, was sunk on Tuesday, August 3. The crew of 22 and the chief officer's wife and child were rescued after being seventy-two hours in open boats.

How or where the Midland Queen was sunk was not intimated which is in accordance with the recent announcement made by the British Admiralty that it will no longer make public information showing the waters in which German submarines are operating, but it is presumed that the vessel was sent to the bottom by a torpedo fired by an undersea boat.

The Midland Queen was built in the year 1901 by the Calendon Shipbuilding & Engineering Co., Dundee, Scotland. She was brought out to Canada, and has been operating on the Great Lakes between Montreal and Port Arthur and Fort William.

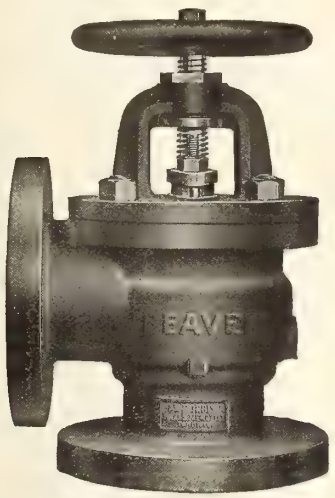
AT THE

Canadian National Exhibition

You will have a splendid opportunity of inspecting a full display of our high-class

BRASS GOODS

In fact there will be all grades of specialties there—Steam, Electrical, Mechanical, in Brass, Bronze and Iron, for use afloat or ashore, in factories, power plants, offices and homes.



Made in sizes 2½" to 20" in stop or non-return angle or cross valve pattern.

The above illustrates

MORRISON'S Beaver Angle Valves

A high-class valve specially designed for high pressure steam. Iron Body, Bronze Mounted, with regrinding or renewable copper disc valve. Seats are renewable and fitted with set screw to prevent their working loose.

Recessed spigoted joint between body and yoke prevents gasket blowing out.

The outlet being under the level of the seat, there is no pocket where water may lodge when valve is closed. Valve body is tapped for drain from pipe line.

The valve is designed to occupy minimum space while keeping full area through every part. Fitted with brass gland to prevent breaking when packing or rusting in when in operation.

Adapted for working pressures up to 250 lbs. per sq. inch.

Hydraulic test pressure 400 lbs. per sq. inch.

Approved and endorsed by Marine and Fisheries Steamboat Inspection Department

The James Morrison Brass Mfg. Company, Limited

93-97 Adelaide Street West, Toronto, Canada

FORCING THE DARDANELLES

has proved a gigantic task. The Turks said it was imposible, so heavy were the fortifications guarding the land defences, so thick were the mines strewed in the waters of the Straits.

But the impossible is going to take place. The Gates of the Golden Horn are to be opened, and the world will witness the supreme spectacle that crowns a herculean task fought to a triumphant issue.

Our readers and advertisers have been watching this contest in the Eastern Seas with bated breath. It has stirred them in a dramatic way. They, too, are confronted with a great task. They are engaged in commercial warfare to uphold their own supremacy in business.

Forcing the Dardanelles is a timely object lesson. To force it successfully the utmost resources in strength of guns and strategical genius were brought to bear.

And so with business.

Business on a peace footing is rarely successful. Continuous endeavor to meet everchanging conditions, and judicious advertising to promote your sales and affirm your stability, are essential to true progress.

Force, well directed and timely, spells commercial victory. One of the strongest forces known to business science is the ADVERTISING FORCE. Write us about it to-day.

Marine Engineering of Canada

143 University Ave.

TORONTO, CANADA

ASSOCIATION AND PERSONAL

A Monthly Record of Current Association News and of Individuals Who Have Been More or Less Prominent in Marine Circles

Hon. J. D. Hazen, Minister of Marine and Fisheries, has gone on a tour of inspection down the St. Lawrence. He will inspect the lifeboat and naval stations.

Capt. Henry Murphy, master of the steamer Chicago of the Western Transit Co.'s line, suffered suspension of his master's and pilot's license for ten days from August 2 by order of the United States local inspectors in Detroit, following their investigation of the collision between the Chicago and the James B. Eads in Lake St. Clair on the morning of June 7.

To Encourage Enlistments.—The directors of the Canada Steamship Lines, are guaranteeing to every employe, married or single, his position when he returns from the front, and they have decided to insure the lives of all married men among the company's employes who enlist. To dependents of married or single men they are paying ten dollars a month. They will also advance training fees to those enlisting in the aviation corps.

M. Beatty & Sons, Ltd., Welland, Ont., announce that the control and management of the company has been changed. H. L. Beatty has been elected president, and A. O. Beatty, vice-president and general manager. Harris T. Dunbar, of Buffalo, has been elected a member of the board of directors. V. R. Browning, B. F. Miles, directors, and R. A. Greene, general manager, who have had charge of the business for the past three years, have severed their connection with the company.

Walter K. Greenbaum, manager of the Indiana Transportation Co., was indicted by the County Grand Jury, Chicago, on August 27, charged with manslaughter in connection with the Eastland disaster. His company leased the steamer for the excursion, which was blocked by the capsizing of the Eastland in the Chicago River with the loss of nearly a thousand lives. The indictment charges that the boat was unseaworthy and overloaded.

"Batiscan"—"Bengore Head" Collision.—The Dominion Wreck Commissioner's Court on August 26 rendered a decision in the case of the collision between the steamer Batiscan, of the Dominion Coal Co., and the Bengore Head, of the Head Line, off Cape Salmon on August 3. Captain Green, of the Batiscan, was suspended for two years, Pilot James Lachance of the same steamer was fined $300, while Pilot Alfred Raymond, of the Bengore Head, who left his ship after the collision, and went on board the Batiscan, was deprived of his license.

LICENSED PILOTS.

ST. LAWRENCE RIVER.

Captain Walter Collins, 43 Main Street, Kingston, Ont.; Captain M. McDonald, River Hotel, Kingston, Ont.; Captain Charles J. Martin, 13 Balaclava Street, Kingston, Ont.; Captain T. J. Murphy, 11 William Street, Kingston, Ont.

ST. LAWRENCE RIVER, BAY OF QUINTE, AND MURRAY CANAL.

Captain James Murray, 106 Clergy Street, Kingston, Ont.; Capt. James H. Martin, 259 Johnston Street, Kingston, Ont.; John Corkery, 17 Rideau Street, Kingston, Ont.; Captain Daniel H. Mills, 272 University Avenue, Kingston, Ont.

ASSOCIATIONS

DOMINION MARINE ASSOCIATION.

President—A. E. Mathews, Toronto. **Counsel**—F. King, Kingston, Ont.

GREAT LAKES AND ST. LAWRENCE RIVER RATE COMMITTEE.

Chairman—W. F. Herman, Cleveland, Ohio Secretary—Jas. Morrison, Montreal.

INTERNATIONAL WATER LINES PASSENGER ASSOCIATION.

President—O. H. Taylor, New York.
Secretary—M. R. Nelson, 1184 Broadway, New York.

THE SHIPPING FEDERATION OF CANADA

President—Andrew A. Allan, Montreal; **Manager and Secretary**—T. Robb, 218 Board of Trade, Montreal; **Treasurer**, J. R. Binning, Montreal.

GRAND COUNCIL, N.A.M.E. OFFICERS.

L. B. Cronk, Windsor, Ont., Grand President.
A. F. Hamelin, Montreal, Que., Grand Vice-President
Neil J. Morrison, P. O. Box 238, St. John, N.B., Grand Secretary-Treasurer.
E. Read, Vancouver, B.C., Grand Conductor.
A. J. Ross, Halifax, N.S., Grand Doorkeeper.
James Gillie and A. E Kennedy, Kingston, Ont, Grand Auditors.

CANADIAN PACIFIC OCEAN SERVICES.

THE new corporation under which the steamships of the Canadian Pacific Railway and of the Allan Line will be operated after the middle of October or first of November, is to be known as the Canadian Pacific Ocean Services. However, the announcement made by Sir Thomas Shaughnessy in connection with the matter is to the effect that the Allan system will not be obliterated but will be continued under the same name just as the White Star Line retains its identity under the International Mercantile Marine combine. Further, Sir Thomas states that the Allan Line will have financial backing for the improvement and enlargement of its fleet that it did not have before it established the changed relations now going into actual effect.

INTERNATIONAL MERCANTILE MARINE REORGANIZATION.

THE plan for the reorganization of the International Mercantile Marine Co., provides for a reduction of the capital from about $175,000,000 to $89,371,000. It is said this latter figure represents fairly the intrinsic value of the property without regard to the items of goodwill, trade names, connections or routes, and that the fixed charges will be within the net earnings.

1915 Directory of Subordinate Councils, National Association of Marine Engineers.

Name.	No.	President.	Address.	Secretary.	Address.
Toronto,	1	Chas. M. Arnott,	94 Hanley Street	J. S. Adams,	631 Gladstone Ave.
St. John,	2	G. J. McVicar,	49 Winslow St. West	G. T. G. Blewett,	36 Murray St.
Collingwood,	3	Wm. Whipps,	Collingwood, Ont.	Robert McQuade,	Collingwood, Ont.
Kingston,	4	L. E. Spencer,	24 Clergy St.	James Gillie,	101 Clergy St.
Montreal,	5	Henry Lamereaux,	280 St. Andre St.	O. L. Marchand,	2378 Clark St.
Victoria,	6	John E. Jeffcott,	Esquimault, B.C.	Peter Gordon,	808 Blanchard St.
Vancouver,	7	W. G. Wooster,	Room 10, Jones Bldg.	E. Read,	Room 10-12, Jones Bldg.
Levis,	8	Michael Latulippe,	Lauzon, Levis, Que.	S. G. Guenard	Bienville, Levis, Que.
Sorel,	9	Nap. Blandon,	Sorel, Que.	Alf. Charbonneau,	Box 204, Sorel, Que.
Owen Sound,	10	John McLeod,	570 4th Ave.	J. Nicoll,	714 4th Ave. East
Windsor,	11	Alex. McDonald,	28 Crawford Ave.	Neil Maitland,	221 London St. W.
Midland,	12	Geo. E. Wilson,	P.O. Box 204	Roy N. Smith,	Box 178
Halifax,	13	Robt. Blair,	29 Preston St.	Chas. E. Pearce,	Portland St., Dartmouth, N.S.
Sault Ste. Marie,	14	Charles H. Innes,	27 Euclid Rd.	Geo. S. Biggar,	43 Grosvenor Ave.
Charlottetown,	15	Philip Bridges,	Stewart St.	Chas. Cumming,	27 Easton St.
Twin City,	16	H. W. Cross,	136 Ambrose St	E. L. Williams	142 Secord St., Port Arthur, Ont.

The International Mercantile Marine Co., was one of the least fortunate of the many big mergers started when money was cheap and speculation high. It did not have an opportunity to give value out of its profits to its stock which represented no capital investment and so to save itself the stock in question is to be eliminated. Things financial are getting down to a solid foundation in some cases.

Catalogues

Gaskets—The Niagara Falls Gasket & Packing Co., Niagara Falls, Ont., has issued a leaflet dealing with their line of metal asbestos gaskets and the Ames alloy metallic sheet packing.

Turbo-Generators.—The many advantages of the turbo-generator in small and moderate sizes are set forth in detail in Bulletin No. 54, just issued by the Kerr Turbine Co., Wellsville, N.Y. Many interesting installations of "Economy" turbo-generators are also described and illustrated. Copies will be mailed upon request.

Burning Crude Oil is the title of a bulletin dealing with one of the principal features of the De la Vergne oil engine, viz., the spray valve and vaporizer. A cross section through the cylinder head shows the construction of the apparatus. Copies of the bulletin may be obtained from the De la Vergne Machine Co., New York, N.Y.

Crude Oil Engines. — "Munktell" crude oil engines are described in a comprehensive manner in special catalogue No. 5. The method of operation is described at length, each part of the engine being taken in detail. Tables of prices and dimensions are included for each type, accompanied by illustrrations and diagrams. Copies of the catalogue may be obtained from the Canadian representatives, Hyde & Sons, Ltd., Montreal, Que.

Gas Powrule.—A useful device in the form of a slide rule has been put on the market for giving the approximate horse-power developed in four-cycle gas and gasoline engines, and also in two-cycle semi-Diesel oil engines. While the rule is not intended to give absolutely accurate results, it furnishes a means of comparing the various size engines in relation to the bore, stroke and speed. This device is called the "Gas Powrule," and can be obtained from the patentee, D. O. Barrett, 802 S. McDonald Street, Lima, Ohio, for 75 cents.

Steam Trap Catechism is the title of a new booklet which has just been issued by the American Steam Gauge & Valve Mfg. Co., Boston, Mass. The booklet contains considerable information of interest to users of steam traps, and includes descriptions of various types. Other matter covers the operation of steam traps, water-hammer, and wire-drawing in steam traps, ratings, selection of suitable sizes and limits on buying steam traps, etc. An illustration is shown of the "American" Ideal" trap, accompanied by a diagram and table of dimensions. This booklet may be obtained from the head office of the company, or at any of the branches.

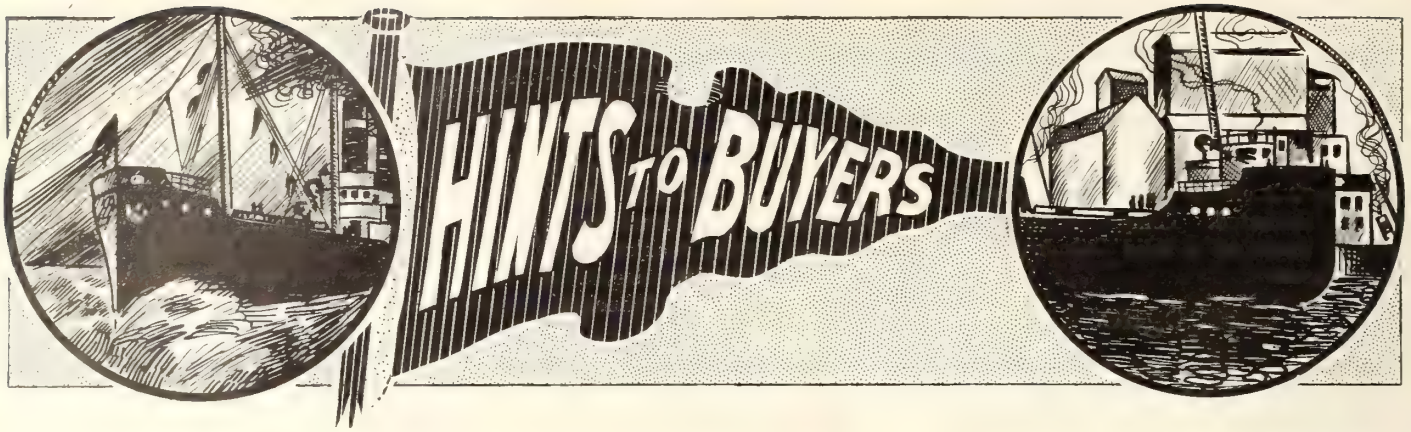
Book Reviews

List of Lights and Fog Signals on the Atlantic Coast, inland waters and on the Pacific Coast of the Dominion of Canada, has been published by the Department of Marine, Ottawa. The lists are in three sections, as indicated above, and are corrected to April 1st, 1915.

"**The Coking of Coal at Low Temperatures,** with Special Reference to the Properties and Composition of the Products," by S. W. Parr and H. L. Olin, has been issued as Bulletin No. 79 of the Engineering Experiment Station of the University of Illinois. This report covers a series of studies made in continuation of the work on the coking of coal at low temperatures, described in Bulletin No. 60. Coke resulting from the low temperature process contains from 18 to 22 per cent. of volatile matter but retains none of the tar forming constituents. In domestic appliances it kindles readily and burns with a bright, smokeless flame. A suction gas-producer test made with this fuel compared favorably in ease of operation and efficiency with similar tests of anthracite. The tar has a specific gravity of 1.069, contains less than 2 per cent. of free carbon and is rich in low boiling substances, many of which are suitable for use in internal combustion engines. Its adaptability to wood preservation processes is shown by its high content of tar acids, which constitute nearly 30 per cent. of the crude material. The pitch residue amounts to 30 per cent. and is low in precipitated carbon. Naphthalene is absent. Results of these studies show that the coke, tar, and gas have specific properties of especial value, and indicate that the process of coking at low temperatures could be established successfully on a commercial basis. Copies of Bulletin No. 79 may be obtained gratis upon application to C. R. Richards, Acting Director of the Engineering Experiment Station, University of Illinois, Urbana, Ill.

A Study of Boiler Losses, by A. P. Kratz, has been issued as Bulletin No. 78 of the Engineering Experiment Station of the University of Illinois. This bulletin presents a critical analysis of the data obtained from a series of twenty-five trials made on a 500 horse-power Babcock and Wilcox boiler located in the heating plant of the University. The boiler was operated under varying conditions of load and depth of fuel bed. Curves are presented and conclusions are drawn regarding the conditions necessary in order to secure the best continuous operation. In these tests, gas samples were taken both at the bridge and in the breeching, and a determination of the loss due to air leaking through the setting was made. A curve is also given which shows the percentage of excess air represented by the different amounts of CO_2 appearing in the gas. The heat balance has been subdivided so as to isolate and determine the amount of the several losses chargeable to the boiler, furnace and setting. Complete forms for calculating a series of boiler trials are given, and the corrections for differences in pressure and water levels at the beginning and end of a test are discussed. Tests were also made using some samples of coal which had been exposed to the weather for about six years. An interesting fact brought out was that no difficulty was experienced in burning the weathered coal. It had deteriorated until it was of about the same composition and grade as the fresh Vermilion County screenings, and its steaming qualities compared very favorably with those of the latter. Copies of Bulletin No. 78 may be obtained gratis upon application to C. R. Richards, Acting Director of the Engineering Experiment Station, University of Illinois, Urbana, Ill.

Scottish Shipbuilding.—The mercantile output of Scottish shipbuilding yards continues small in comparison with those of corresponding months of previous years. The total for Scotland during July consisted of only five vessels of about 15,930 tons, while there were launched on the Clyde only three vessels of 15,630 tons—one of them, however, a first class liner of large size. For the seven months the Clyde total consists of 53 vessels of 154,603 tons. This is less than the total output of the first seven months of last year by 129,290 tons, and by that of 1913 by 222,667 tons. The fact, however, that no Government vessels are included this year deprives the comparison of any real value. There is of course plenty of work in the yards, but the supply of labor continues scarce. No fresh mercantile contracts were reported during the month.



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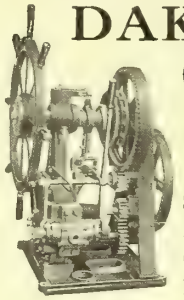

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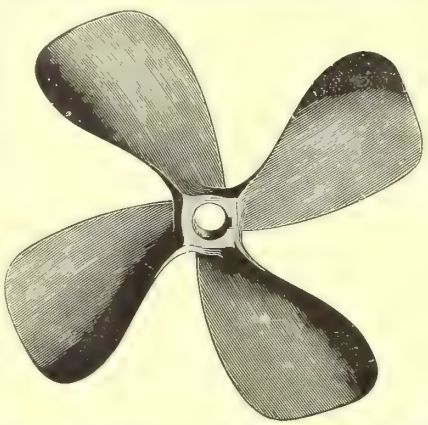

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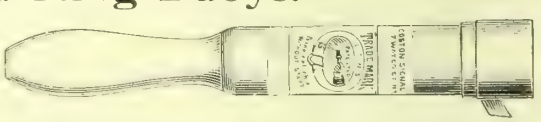

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The Publisher's Page

By B.G.N.

The Submarine as a Creator

Nowadays the prophet who cares anything at all about his reputation will qualify his statements and wind up all his prophecies about the probable results of the war with—"This may happen or it may not."

We lay no claims to being prophets, soothsayers, or clairvoyants, but from what we know it would appear that after the war — and perhaps before the struggle ends—Canadian shipbuilding is going to boom.

The submarine is, strangely enough, the friend of the shipbuilder. Many good ships that proudly bore our commerce are now gruesome haunts of strange creatures on the bottom of a pirate-infested ocean. More good ships will likely find an eternal anchorage in the same place.

These good ships will have to be replaced. Their engines, boilers, dynamos, and equipment from stem to stern will have to be replaced.

Some of these new vessels will undoubtedly be built in Canada, and we believe more ocean-going boats will be overhauled in Canadian drydocks than heretofore.

It is quite probable that new shipyards will be established on the Atlantic Coast. If so, they will have to be equipped.

Our shipbuilding plants on the inland lakes will undoubtedly participate in the wave of prosperity which seems headed direct for Canada.

And since advertising is such a potent force in influencing business, it would seem like mighty good policy for interested parties to start in NOW and bring their lines to the attention of the readers of this—Canada's only exclusive Marine paper.

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Car Ferry Steamer "Ontario No. 2" Ready to be Commissioned

Staff Article

Last month our feature article dealt with the then newly-commissioned Canadian Government buoy and lighthouse steamer "Grenville." In the present instance, a somewhat more pretentious and powerful craft from the same shipyard is described and illustrated, and, needless to say, in her special purpose design, construction, equipment and appointments, the "Ontario" No. 2, gives added prestige to Canadian skill and enterprise.

THE large car ferry, Ontario No. 2, built for the Ontario Car Ferry Co., made her initial trip, builder's trial, on Aug. 28 from the yards of the Polson Iron Works, Ltd., Toronto, Ont., where she was built and engined. Captain F. D. Forrest, commodore of the Ontario Car Ferry Co. fleet, was in command, and the trial was successful in every respect. The Ontario No. 2, like her sister ship, Ontario No. 1, will run between Cobourg, Ont., and Charlotte, N.Y., connecting up with Buffalo, Rochester and Pittsburgh, and the Grand Trunk Railways. She is designed for carrying 30 coal cars of 68 tons gross weight and 1,000 passengers on deck, and has cabin accommodation for 32 passengers.

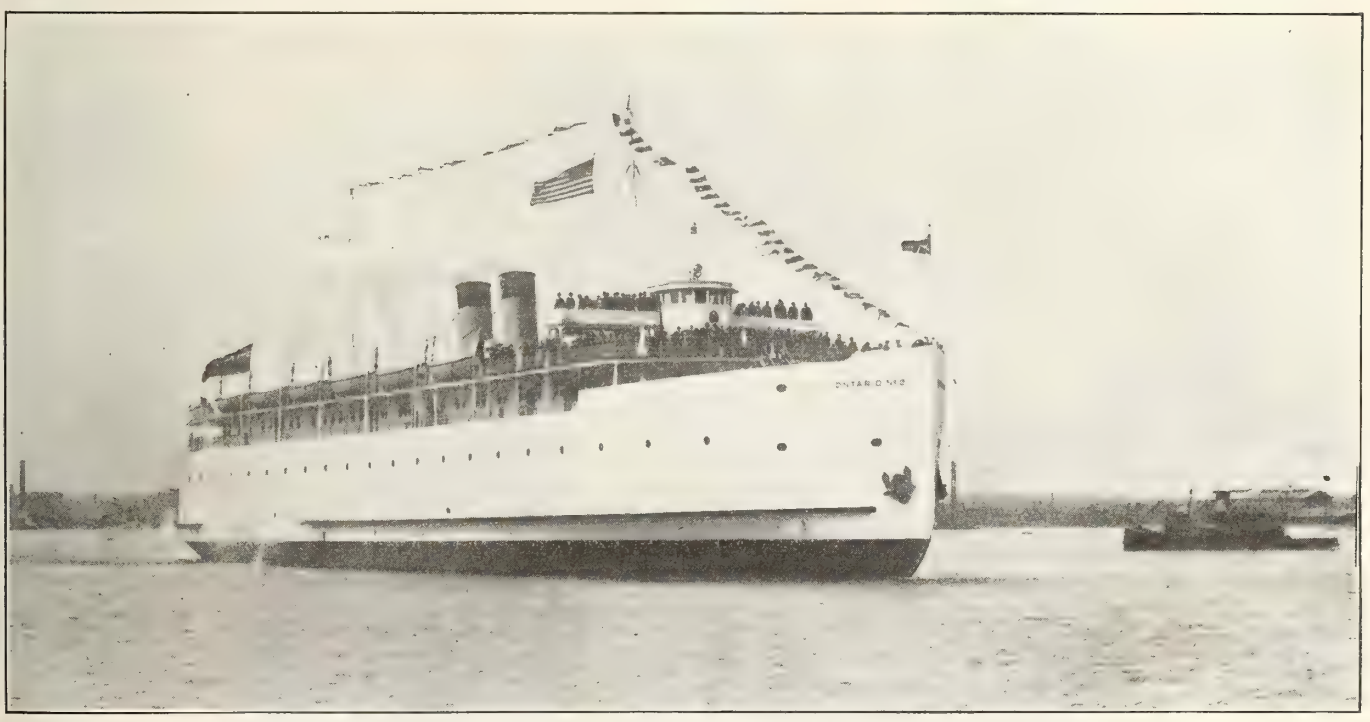
The keel was laid on Nov. 7, 1914 and the ferry was launched on April 3 of this year, while the trial trip, as stated above, was run on Aug. 28, the construction thus covering a period of about eleven months. The ferry was built under the supervision of William Newman, naval architect and works manager of the Polson Iron Works, and was designed by Hugh Calderwood, naval architect for the owners. the Ontario Car Ferry Co. She will be placed in service on Oct. 1 to replace her sister shop, Ontario No. 1, which will be laid off for overhaul. Capt. F. D. Forrest has been appointed to the command of the ferry, and Allan Nichol is chief engineer.

The principal dimensions are as follows: Length overall, 318 feet; length between perpendiculars, 307 ft. 6 in.; beam molded, 54 feet; beam molded on main deck, 56 ft.; depth to main deck, 20 ft. 6 in.; depth at centre, main deck to promenade deck, 17 feet; depth at side main to promenade deck, 17 feet; draft fully loaded, 16 ft. 3 in.; tonnage 5,400; horse-power, 4,500; camber of main and promenade decks, 9 in.; rise of floor, 2 feet. The ferry has a service speed of 13 miles per hour, but is capable of making 15 miles per hour in case of necessity.

The Ontario No. 2 is a steel twin-screw car ferry of the shelter deck type with four tracks for cars on the main deck, which is of steel throughout. A shelter deck of steel laid flush has a steel deck-house running throughout the greater part of the vessel's length, with accommodation for 1,000 passangers, as well as officers and crew. There is a wooden pilot house and bridge on top of deck-house forward and a pilot house at aft end of same. Six transverse watertight bulkheads extend from the keel to main deck and there is a longitudinal bulkhead on centre line in three deep-water ballast tanks. These tanks are 13 feet deep, two being located forward of the boiler room and one aft of the engine room. A steel lower deck is laid throughout the forward and after holds and both peaks, forming the tops of the deep water ballast tanks. There are two propeller shaft tunnels, one on each side from the engine room to stuffing box bulkhead. Four single ended "Scotch" type boilers are placed amidships with wing coal bunkers on each side in way of boiler room.

Hull Construction

The vessel is built on the transverse system with solid plate floors and bulb angle frames. The shell plating is not reduced forward and the scantlings throughout are extra heavy for work in ice. The bows are designed to break ice as the ferry will operate throughout the whole year. The vessel was built to pass the inspection of the Great Lakes Register to their highest classification. All plates are of mild open hearth steel with a tensile strength of between 54,000 and



THE NEW CAR FERRY "ONTARIO NO. 2" PUTTING OUT FROM TORONTO HARBOR

62,000 pounds per square inch. The stem and stern frames are of best hammered scrap iron and the spectacle frame is of cast steel made in two parts and bolted together on centre line of ship. The rudder is made of best hammered scrap iron, forged in one piece with one cross stay. The frame is covered on both sides with plates and the space between filled with solid pine. A quadrant of cast steel and steel plates is clamped to rudder stock below main deck. The rudder is protected by a steel casting 4 in. thick, to prevent injury when backing through ice.

The frames from after peak bulkhead to stern-post are 8 in. x 3½ in. x 19.17 pound bulb angles spaced 24 in. apart. From the collision to after peak bulkhead the frames are 10 in. x 3½ in. x 25.9 pound bulb angles also spaced 24 in. apart. The frames forward of the collision bulkhead are of the same section as in the after peak, but spaced 18 in. apart on the water line. The frames above main deck are 8 in. x 3½ in. x 19.17 pound bulb angles spaced 39 in. part throughout. The bulkhead frames are of 5 in. x 5 in. x 10.2 pound angles. Counter frames are 6 in. x 3½ in. x 11.7 pound angles. Reverse frames are 3 in. x 3 in. x 7.2 pound angles, on every floor. Floors in engine and boiler space are 33 in. x 20 pound, and 17 pound elsewhere. The centre keelson is 45 in. deep of 25 pound plate throughout, top and bottom—double angles are 5 in. x 4 in. x 14.5 pounds. The keel plate is 48 in. wide of 32½ pound plate. The main deck is of 18 pound plate throughout and the windlass deck of 12½ pound plate with 20 pound plate under windlass. The lower deck is of 12½ pound plate throughout, and promenade deck of 10.2 pound plate throughout.

There are six transverse watertight bulkheads, the collision bulkhead being about 32 feet abaft the stem. There is a bulkhead between the collision and forward boiler room bulkhead, and another dividing the engine and boiler rooms. The sterntube stuffing-box bulkhead is situated about 26 feet forward of stern-post. There are also longitudinal bulkheads in the centre line of ballast tank and in stuffing-box recess, also one on each side of centre line in boiler room forming the coal bunkers. The smoke-stack casings and air trunks in car space are insulated with air cell asbestos.

The vessel is equipped with two "Brittanic" stockless anchors of 4,500 pounds weight each, and 180 fathoms of 1⅞-in. chain. A "Hyde" steam capstan windlass is located in the forecastle for handling the anchors with a capstan on deck. There are also four "Hyde" steam "gypsies" on main deck with engines below. On the promenade deck are twelve 24-ft. metallic life boats fully equipped and hung from Jacques & Huff patent davits. The davits are quick-acting and are fitted with non-toppling blocks. The steam steering apparatus is direct-acting and controlled by Tellemotor gear. A steering wheel on the after part of the boat deck controlling the rudder through shaft and gears is installed for hand operation should the necessity arise.

BUILDERS' NAME-PLATE CAR FERRY "ONTARIO NO. 2"

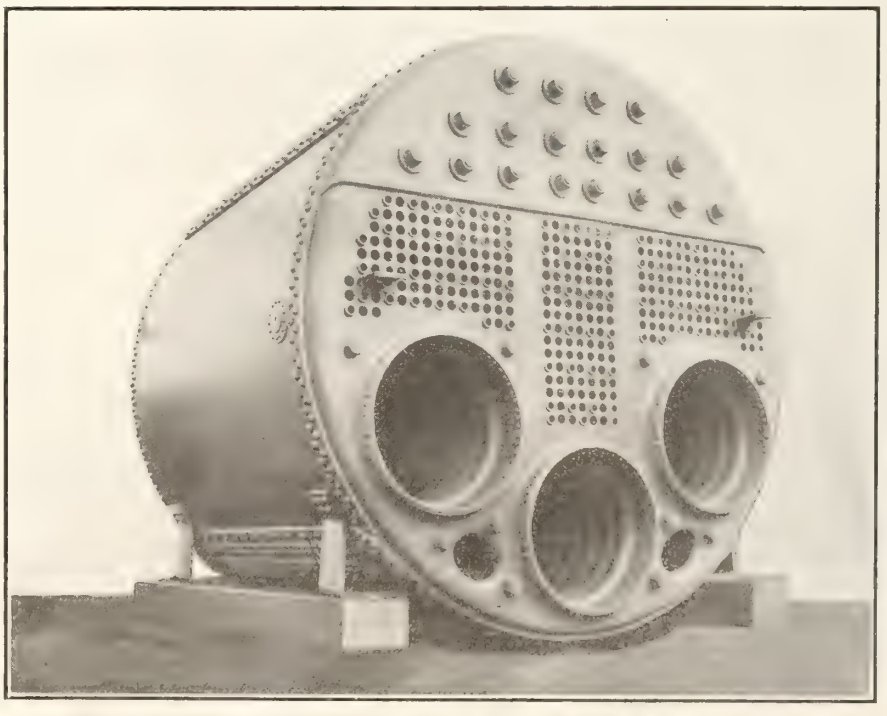
Electric Lighting Plant

The vessel is lighted throughout by electricity, and for this service there is installed two direct-connected marine type generating sets in the engine room space. The units are 15 k.w. and 20 k.w. respectively and were supplied by the Canadian General Electric Co., Toronto. The switchboard is located near the two generating sets, and separate circuits are arranged for different parts of the ship. There are the usual electric mast-head, range and side-lights, while an 11-inch search-light is installed on top of the pilot house and one car headlight on the promenade deck aft. All wiring runs in metal conduits throughout the ship except in the cabins.

Pumping Equipment

The boiler feed is taken care of by two "Worthington" 12 x 7 x 12 in. duplex outside-packed plunger, pot-valve pumps located on starboard side of engine room. On the same side is installed a "Smart-Turner" duplex ballast and general service pump. On the port side is installed a "Worthington" 6 x 4 x 7 in. duplex bilge pump, two "Smart-Turner" 4½ x 2¾ x 4 in. duplex pumps for fresh water and sanitary service respectively, and one "Smart-Turner" 5¼ x 3½ x 6 in. cooler pump. In the engine room forward is a 12-in. centrifugal ballast and bilge emergency pump driven by a vertical engine. This unit was built by the Morris Machine Works, Baldwinsville, N. Y. There are two 16 x 30 x 18 in. vertical condenser air pumps supplied by Deane Bros., Indianapolis, Ind., each mounted on same base as jet condenser.

A refrigeration plant with capacity of 2 tons per 24 hours is installed on the promenade deck. The machine which is motor driven and works on the sulphur dioxide system, was built by the



ONE OF THE BOILERS INSTALLED IN CAR FERRY "ONTARIO NO. 2"

Audriffen-Singram Ice and Refrigerating Machine Co., and installed by their agents, the Canadian Griscom-Russell Co., Toronto. In connection with the plant there is a cooling room, also on the promenade deck, and a brine tank for making can ice. The drinking water is also cooled by this system. A storage tank for fresh water is located on the boat deck. The water passes into a tank in the cooling room where it is cooled for drinking purposes.

On the main deck forward, accommodation is provided for firemen, deckhands, etc., while on the promenade deck are the passenger cabins, the engineers' and waiters' quarters, kitchen and dining room to accommodate 32 persons, purser's office and quarters, smoking room, ladies' sitting room and music room, lavatories, bathrooms, baggage rooms, store rooms, etc. The captain's and officers' quarters and pilot house are on the boat deck.

THE NEW CAR FERRY "ONTARIO No. 2" PASSING THROUGH THE EASTERN GAP BETWEEN TORONTO ISLAND AND THE MAINLAND

Machinery

There are two sets of main propelling engines operating twin screws turning outboard. Each engine is of the triple expansion , jet-condensing type, with cylinders 20½ in., 33 in. and 54 in. diameter by 30 in. stroke, running at 110 r.p.m. All valves are on the centre line, the h.p. and i.p. cylinders having solid piston valves and the l.p. a double ported slide valve.

The bed-plate is of cast iron of box section and fitted with six main bearings. The crank-shaft is of built-up type with forged steel cranks shrunk on and set at 120 degrees. The connecting-rods, cross-heads and piston-rods are also of forged steel. The valve gear is the Stephenson motion with double bar links. The eccentric rods are of forged steel, and the straps of semi-steel. The throttle valve is of the straight lift type fitted with a pilot. A complete set of pressure and vacuum gauges, also revolution counter and clock were supplied by the James Morrison Brass Mfg. Co., Toronto.

A cast iron thrust block with horseshoe collars is fitted just aft of each bedplate. The propeller shafting is of forged steel and the stern tubes of cast iron, bushed in the usual manner. The propellers are of semi-steel, 12 ft. diameter by 14 ft. pitch, with 4 blades recessed full depth of flange into the cast steel hub.

Boiler Room

There are four "Scotch" marine type boilers installed, each being 14 ft. diameter and 12 ft. long. The working pressure is 180 pounds per sq. inch. Each boiler is fitted with three "Morrison" corrugated furnaces, 42 ins. inside diameter, and flanged at both ends. The tubes are of seamless drawn steel, 3 in. diameter. The breeching has an inner and outer casing with asbestos millboard between. The boilers are equipped with "Howden's" forced draft, two direct-connected steam-driven fans being installed in the engine room for this purpose. These units were supplied by Jas. Howden Sons & Co. Glasgow, Scotland. The fan is of the straight vane type and the engine of the vertical, enclosed forced lubrication type. Between the two sets of boilers in the stokehole are two 7-in. "See" ash ejectors.

Guests.

Among those on board, which included a large number of ladies, were: Col. J. B. Miller, W. H. Smith, J. W. Griemer, fleet engineer of the Ontario Car Ferry Co., and W. F. Crawford, the chief steward; Captain Harry Polson; William Newman, naval architect and works manager of the Polson Company, who superintended the construction of the new vessel; A. H. Jeffrey, A. E. Matthews, Captain W. J. Bassett, J. T. Mathews, Captain M. Corcoran, Mayor Church, Alderman Ramsden, Alderman Ryding, J. W. Somers, George Stevenson, Captain Evans, John Dodds; H. E. Wittenberg, General Superintendent, G. T. R.; W. H. Farrell, Superintendent of G. T. R. Terminals; E. C. Horning, District Passenger Agent, G. T. R.; Edmund Bristol, M.P.; W. C. Seeley, Master Mechanic of the Middle Division, G. T. R.; J. R. Leckie, Assistant Master Mechanic, G. T. R.; W. S. Wilson, Superintendent of Transportation, G. T. R.; W. Hamilton, L. Grabbel, Assistant General Baggage Agent, G. T. R.; J. D. O'Connor, J. W. McClintock, James Stewart, ex-Alderman James McCausland, Frank Ryding, Jack Edmunds, A. G. Webster, "Marine Engineering of Canada," etc.

Official Trial

The Ontario No. 2 left Toronto for her official trial on Tuesday, Sept. 14, going first to Charlotte, N.Y., and then back across the lake to Cobourg, Ont. The trials were in every way satisfactory both to builders and owners.

Capt. Forrest was in command of the Ontario No. 2, and J. Sharp, chief engineer of the Polson Iron Works, took charge of the trials on behalf of the builders. Hugh Calderwood, naval architect, represented the Ontario Car Ferry Co., in an official capacity. Allan Nichol, chief engineer of the Ontario No. 2, was on board.

HEROIC WORK OF BRITISH SEAMEN.

THE responsible part played by our Mercantile Marine in the present war was discussed in an address delivered the other day at the Sailors' Club in Montreal by Captain J. T. Walsh, R.N.R., marine superintendent of the C.P.R. Atlantic Steamships. "At one time," said Captain Walsh, "it was considered that on account of the officers and men being distributed all over the globe, the number procurable at short notice would be so small that their value as a naval reserve would not be very great. On this account a short service scheme was created in the naval service, from which men passed into the Royal Fleet Reserve, and through it an immediate reserve was always available.

"It was found, however, that directly the R. N. R. was called upon, they flocked to the rendezvous in such numbers that it was difficult to place them all. Not only did they return from ships all over the world, but also in very large numbers from positions on shore, even from farms on which they had settled in Western Canada and other places. Of these men, however, it may be said they only did their duty. That is quite true, but it is the way in which they did it that calls for special appreciation, and they have earned the right to special consideration after the war.

"The British Admiralty were considerate, and, where possible, allowed the masters and officers to remain in their ships. In a general way the steamship owners did not suffer so badly as was generally expected. When we consider that there are probably over 2,000 captains and officers of the mercantile marine, and, including men employed in the trawlers and other mine laying and mine sweeping operations, considerably over 20,000 men, and that the work of the ocean-carrying passenger and freight service is going on as usual, it is indeed an honor to belong to a service that has done such excellent work.

Armed Merchantmen

"The work done by the armed merchant cruisers, whose crews were mostly R. N. R. and mercantile marine men, also calls for special praise. In September last the Carmania and Cap Trafalgar met in fair fight, evenly matched. The Carmania was in charge of Captain Noel, R.N., with Captain Barr, second in command. The Briton's skill at his own work secured them the victory in a little over one hour's battle. The Carmania was holed in over 300 places, being hit by almost 100 projectiles. Lieut. Murray, late chief officer of the Canadian Pacific SS. Lake Manitoba, was working a gun on the forward decks, when a projectile struck the forward winch, a splinter from which struck him down, injuring his spine. He is one of the many whom this dreadful war has ruined. Captain Barr was gazetted a Companion of the Order of the Bath.

"Over 80 vessels were commissioned as armed cruisers. The Otranto was with the Monmouth and Good Hope under Admiral Craddock. The Orama, a ship of the Orient Line, was with one of the vessels that cornered the Emden. The P. & O. steamer Macedonia was with Admiral Sturdee at the Falkland Island fight and helped to sink the Baden, and the steamers Isabel Transport and the Empress of Japan, of the C.P.R., captured the collier Oxford, which served the Emden.

"Mercantile cruisers suffered much, from one reason and another. The

CAPT. J. T. WALSH,
Marine Supt. C.P.R. Atlantic Steamships, Montreal.

Oceanic, early in the war, stranded in a fog. The Clan McNaughton and Vikhur were destroyed by mines. The Bayano was torpedoed with all on board, and was, indeed, a sad loss, as she was mostly manned by R.N.R. seamen and fishermen of the Newfoundland branch of the R. N. R.

Mine Sweeping and Mine Laying

"Probably the most dangerous and comfortless of all the naval and auxillary naval services is that of the mine sweeping and mine laying fleet manned almost altogether with R. N. R. officers and mercantile seamen and fishermen. An officer (Lieut. Boothby), late of the C. P. R. service, was blown up on three different occasions and escaped. He has since been decorated by the King.

"In May, Sub. Lieut. Kersely, R. N. R., commanding the trawler Meuro, with three other armed trawlers, engaged two German torpedo boats. Sub. Lieut. Kersely rammed one of them; the Germans then fled, but were chased and overhauled and sunk by a division of fast destroyers. This latter affair was carried out by the trawlers with a coolness worthy of the best traditions of the R. N. and showed the bull dog fighting value of the British seamen. Without doubt, the mine laying and mine sweeping fleet, on account of their specially dangerous duties, deserve perhaps a greater measure of praise and appreciation than any other unit of the service.

Bull Dog Pluck.

"With regard to masters, officers and men who were not in the R. N. R. and who were free agents at liberty to do what they liked, no praise would be too great. They have done their bit well and faithfully. The German submarine did not frighten them; they knew they had a duty to their Country, to their homes, to their wives, their children and their parents, but they put their country's honor first and left home and friends, to man their ships, and so transport troops, ammunition, horses and food-stuffs the world over, not to England or the British Isles only, but also to the several distant parts of the world in which the Empire and her Allies were fighting for their God, their Country, and their Flag.

"Apart from all this, the masters, officers and men of the mercantile marine have done some excellent effective fighting work. Take the case of the Thordis. Captain Bell, when chased by a subsubmarine, instead of running away, turned his ship around and rammed her, leaving one less pirate to prey on unarmed, helpless ships.

Jellicoe a Son of the Sea

"The officers and men of the Mercantile Marine take great pleasure in knowing that the Admiral, Sir John Jellicoe, in supreme command afloat of His Majesty's Naval Services, is the son of a ship master of the British Mercantile Marine, and one who gave the people whom he served for a long number of years extreme satisfaction, and who always stood out as a fine example of the British Mercantile Marine ship master. I might just quote one more notable example of the bull dog pluck and devotion to duty which was shown by Captain Parslow and his officers while aboard the Anglo-Californian, carrying horses for the British Admiralty. The ship was overhauled by a German submarine, but the commander refused to surrender and endeavored to out-manoeuvre the pirates. For four hours the U boat bombarded the defenceless Anglo-Californian, and Captain Parslow was killed. Thereupon, his son, who was an officer under him, assumed command and piloted the ship to Queenstown. As a sailor, I am absolutely satisfied that, come what may, the Mercantile Marine can be relied on to do its part to the bitter end."

Dominion Wreck Commission Inquiries and Decisions

Following the proceedings of a vessel stranding or collision inquiry is fascinating alike to the mariner and landsman. Much food for thought is always available, and in not a few instances it seems well nigh impossible to reconcile our conception of disaster prevention achievement when confronted with a detailed recital of the circumstances which contribute to many marine tragedies, not only in our own waters but the wide world over.

S.S. "ROMERA" STRANDING

A FORMAL investigation into the causes which led to the s.s. Romera touching on the north shore of the River St. Lawrence, between Cape Dog and Cape Salmon, on August 16, 1915, was held at Montreal, on August 26, 1915, before Captain L. A. Demers, F.R.A.S., F.R.S.A., Dominion Wreck Commissioner, assisted by Capt. Francis Nash and Capt. James Black, acting as nautical assessors. The Shipping Federation of Canada was represented by F. E. Meredith, K.C.; while C. A. Duclos, K.C., appeared on behalf of the pilot, Arthur Lachance. The following witnesses were examined:—Captain R. Fair, Pilot Arthur Lachance, Second Officer P. Laurie, Engineer J. Carnegie, Lookout J. Kotch, and Wheelsman Wm. Edwards.

Master's Evidence

The captain. Roger Fair, deposed that the Romera was a steel ship of 3,188 tons net and 4,949 tons gross, with a speed of 11½ knots, and carrying a crew of thirty, including two duly-certificated officers; that she had a single screw, with triple expansion engines, and was owned by the Glasgow United Shipping Co.

On this voyage she was bound to Montreal from Boulogne. She took a pilot on board at Father Point, and when in the vicinity of Red Island the weather thickened, with a mixture of fog and smoke. The master averred that he was somewhat of a stranger to the St. Lawrence. He had been there three times this summer, however, and on each voyage he had the same pilot, whom he always found reliable and attentive to his duties.

On this occasion he left the shaping of the courses entirely to the pilot, and when Cape Dog was abeam, or thought to be abeam, the course was given as S.W. ¼ W., he estimating the distance off shore as one mile, while the pilot estimated Cape Dog to be one and three-quarters of a mile off. The Cape Dog foghorn could be heard, and the course steered from there, S.W. ¼ W., would, in ordinary circumstances, have brought the ship three-quarters of a mile off Cape Salmon.

He remained on deck from the time the weather thickened until the grounding, and when he noticed land ahead he informed the pilot that the ship was close to shore. At the same time he ordered the helm hard to starboard and the engines full speed ahead, the ship having been going slow previously. The idea of the full speed ahead order was to secure more headway on the ship so that she would answer her helm promptly. However, the engines had hardly performed half a dozen revolutions when the ship, in swinging around seemed to have touched either the cliff or a shoal from about 'midships and on the starboard quarter. She did not remain fast, but proceeded on her voyage to Montreal. He stated that the foghorn at Cape Salmon was heard before the touching, but the pilot, after consideration, said it was the echo of Cape Dog.

Pilot's Evidence

The pilot, the next witness examined, swore that he had been piloting for 28 years without an accident for which he was found at fault. After passing Red Island, he reached White Island Lightship, and shaped a course for Cape Dog, S.W. by S., which would have brought him, under ordinary circumstances, to about one mile off Cape Dog. When Cape Dog was thought to be abeam, the foghorn was heard; but the lighthouse could not be seen, and a course S.W. ¼ W. was shaped, with the intention of passing a safe distance off Cape Salmon.

He corroborated the statements of the master as to weather conditions, and said that when the land was perceived the master was quicker than him in giving the order to hard a-starboard the helm to keep away from the cliff; but the ship struck, nevertheless. He stated that the only cause to which he can attribute the grounding is that the tide, which was ebbing, must have had a tendency to draw his vessel in-shore, to which he had not given previous consideration.

He said the courses steered were the usual ones which brought him to the point he wanted to reach. There was no possibility of taking a bearing, as the land was not seen; but he estimated that he passed one and three-quarter miles off Cape Dog, and, therefore, the course he gave was, in his own mind, a safe one. He admitted that from White Island to Cape Dog he had steered the ordinary course, and did not consider the ebb tide would have any effect on the ship so far as sending her more in-shore.

Second Mate's Evidence

The second mate was next called and corroborated the statements of the master and pilot, except that he differs as to the distance the ship passed off Cape Dog, he estimating it at one and a quarter miles. He also stated he heard Cape Salmon whistle frequently on his starboard bow, about a point, before the ship touched. He paid good attention both to the courses steered and the sounding of the whistle. The ship was going slow for a considerable period before the accident, and the rules of the road were strictly observed.

Other witnesses examined did not throw any further light on the matter, simply corroborating the evidence already adduced.

Finding

The court, having carefully weighed the evidence as to the circumstances which brought about this casualty, found the pilot, Arthur Lachance, alone to blame, accepting his statement that he steered his usual courses without, in this case, having regard to the state of the tide or current effecting his ship. In view of the fact that he has had a considerable period of service, and a good record, we shall not use severity for what we consider an error of judgment on his part. We, therefore, condemn him to pay a fine of one hundred ($100.00) dollars not later than October 1st, 1915.

We call his attention, and that of all pilots, to the fact that a safe course can be so considered only when all factors likely to cause ships to deviate, sensibly if not visibly, are taken into account. The fact that the master and second officer supposed the ship to be from one to one and a quarter miles off Cape Dog when abeam; also that there was no anchorage ground in the immediate vicinity, and that the ship was being navigated slowly, the rules of the road being observed to the letter, induces us to deal with the pilot in a lenient manner.

As the master and second officer were practically strangers in these waters, and had had the same pilot on three previous occasions, and found him reliable and attentive, it is quite natural to suppose that they relied on his statement that the ship was one and three-quarter miles off Cape Dog. We, therefore, exonerate both the master and

second officer from all blame in connection with this casualty. The action of the master in putting his helm hard a-starboard, and ordering his engines full speed ahead, to give further impetus to the ship so that she might answer her helm promptly, was proper under the circumstances.

S. S. "ALEXANDRIA" WRECK

THE formal investigation was held at Toronto, Ont., on August 30, 1915, before Captain L. A. Demers, F.R.A.S., F.R.S.A., Dominion Wreck Commissioner, assisted by Captain James McMaugh and Captain John Williams, acting as Nautical Assessors, into the total loss of the S.S. "Alexandria" off Scarboro Bluffs, Lake Ontario, on August 3, 1915. Francis King, of Kingston, appeared on behalf of the owners of the S.S. "Alexandria," the Canada Steamship Lines, Limited, and of the master, William Bloomfield.

Master's Evidence

Captain William Bloomfield deposed that the Alexandria was a wooden built, side-wheel steamer 31 years old, 508 tons net and 863 tons gross, drawing 7 ft. 6 in. and making a speed of 7 to 8 miles loaded; that she carried a crew of 29 all told, including two duly certified deck officers, and he had been master of ships for about 16 years, without any accidents.

He stated that on this occasion he left Port Hope for Toronto, the weather thickening intermittently, with a slight wind astern and very little sea. About four o'clock the weather being misty and thick with rain, he hauled out from his former course, SW by W, one point, to make out the land. When land was perceived it was in the vicinity of Frenchman's Bay, and he hauled out again on the former course. Shortly afterwards the wind rose and blew with great strength, and his vessel became unmanageable. He tried both to bring her towards the land and to keep her away from the land; but she broached to, and the seas striking her carried away the anchor shutters and water rushed into the gangway and penetrated the holds. When he was advised by the engineer that there was a certain quantity of water in the hold, he attempted to make the land; but the ship would not answer her helm.

The wind continued to increase until it rose to the strength of a heavy gale, and the seas roughened rapidly, therefore, knowing that his ship had been repaired, and was stronger at the stern than at the bow, he backed her in to shore, and she finally grounded at a place known as Scarboro Bluff. At the time she grounded there was some three feet of water in her hold, and the fires were put out shortly before.

He gave orders to lower the starboard boats, the first boat with the chief engineer alone in it, getting adrift from the ship. The second boat was manned by the first and second mates and a wheelsman, and lines were fastened so that they could make shore and be brought back again; but this method was ineffective. The balance of the crew were rescued by the life saving crew there and by employees of the company, at about three o'clock in the morning, the ship having been exposed to the fury of the storm from about 5.30 the evening before.

First Officer's Evidence

The first officer corroborated the statements of the master as to weather conditions, and said that he left the master in charge of the steering of the ship after he received an order to jettison some of the cargo from the forward hold, in order to increase the draft of the ship aft, she being then six inches by the head. This operation was, however, found ineffective.

Wheelsman's Evidence

The wheelsman testified that the ship steered well in ordinary circumstances; but on this occasion, in view of the strength of the wind and seas she would not answer her helm and became absolutely unmanageable from his point of view.

Finding

After weighing carefully the evidence adduced with respect to the navigation of the vessel and as to the statements of witnesses regarding the strength of the wind on that afternoon, when it was proven that ships of stronger build than the "Alexandria" had to return to port in view of the wind, which reached the velocity of a hurricane, the Court finds that the master was not guilty of fault. The method adopted in beaching his vessel appears, on the face of it, a peculiar one; but owing to the conditions already mentioned as existing, the vessel could not be brought over to starboard, she would not answer her port helm. He pursued an unusual course of backing his vessel to the shore, which, however, appears to have been successfully performed. We may say that under the circumstances the fact that no lives were lost is providential.

In view of the conditions prevailing at that time, the nature and build of the vessel, her light draught—about 7 ft. 6 in.—we exonerate the master from all blame with reference to the loss of his ship.

As the mate did not take part in the operations, having been away from the bridge superintending the jettisoning of the cargo along with the rest of the crew, he is not held to blame in any way.

"BATISCAN"-"BENGORE HEAD" COLLISION

ENTIRE blame for the collision between the steamship Batiscan and the Head liner Bengore Head, off Cape Salmon, in the River St. Lawrence, at 2.10 o'clock on the morning of August 1, has been placed on the former vessel in the judgment given by Captain L. A. Demers, Dominion Wreck Commissioner, at Montreal. Captain Green's certificate is suspended for a period of two years, from August 16, 1915, with the proviso that on August 1, 1916, a certificate of first mate shall be given to him to be retained until the expiration of his term of suspension, on the ground that he had not navigated his vessel with caution, although in full command of the ship.

Pilot Jules Lachance, of the Batiscan, is only held partly to blame because Captain Demers held the collision was due to bad seamanship, and not to lack of local knowledge. As he was consulted by Captain Green, of the Batiscan, in connection with the orders, and acquiesced in them he was fined $300, payable $100 a month until the fine is paid.

On the Bengore Head everyone was exonerated from blame for the collision, including the pilot, Alfred Raymond. The latter, however, had his license cancelled because he deserted his post immediately after the collision. Of the nautical assessors, Captain Francis Nash and Captain James Murray, both agreed with these findings except that Captain Murray brought in a minority report against the suspension of pilot Raymond's license, as he thought there were mitigating circumstances, especially when considered, in view of the man's clean record.

Investigation Details

The formal investigation was held at Quebec on August 13, 14 and 16. F. E. Meredith, K.C., and A. R. Holden, K.C., appeared on behalf of the owners of the Bengore Head, her masters, officers and pilot. Aime Geoffrion, K.C., and W. R. L. Shanks appeared on behalf of the owners of the Batiscan and her master. C. A. Duclos, K.C., appeared on behalf of the cargo interests on the Bengore Head, and L. St. Laurent appeared for the Batiscan pilot.

Bengore Head Captain's Evidence

Captain G. A. Johnson, of the Bengore Head testified that his vessel had left Montreal with a general cargo, including deals on deck, for Belfast. Half an hour after midnight they passed a mile off Morin shoal, and he left the deck, ordering that he should be called if the weather became hazy or foggy.

As fog came on at 1.20 o'clock he was called. At 1.25 the order "slow" was given to the engine room, five minutes later "standby" was ordered, while a "one blast" signal was sounded at regular intervals. At 1.40 the engines were stopped. At 1.50 Cape Salmon fog horn was heard abeam. At 1.55 a two-blast signal was heard on the port bow from half a point to a point. At 2.03 the engines were put slow ahead and the helm ported one point.

At 2.08 the mast head light and the green light of a vessel were observed and the engines were put full speed astern, and the helm hard to port. The collision came immediately, and orders were given and executed to get the boats ready. The ships remained together for a little time. When they separated he noticed that his pilot was absent. Ten minutes later he returned from the Batiscan, which he had boarded. Soundings showed that the vessel was filling rapidly, and she was headed southward, and beached on Hare Island Reef. When the engines were put at full speed astern, the three-blast signal to indicate the movement was not sounded. With the exception of the last two orders, that is, "Full speed astern" and "Hard aport," all orders were given by pilot Raymond.

With reference to the disappearance of the pilot, Captain Johnston said that while the ships were locked together the bow of his vessel was in the water to the hawse pipes, and he fully believed that the vessel was sinking.

Batiscan Captain's Evidence

Captain G. Gardner Green, of the Batiscan, testified that he held a Canadian master's seagoing certificate, and that he had been in command for eleven years. The Batiscan left Sydney, N.S., for Montreal with 6,962 tons of coal, experiencing fair weather until July 31st. One hour after passing Bic witness went on the bridge, remaining there until the collision with the exception of ten minutes during which the fog had cleared. At 1.30, Sydney time, Cape Dog was sighted between half a mile and a mile off, but no bearings were taken. Later a "one blast" whistle signal was heard half a point off the port bow, the course then being S.W. ½ W., Cape Salmon bearing right ahead.

It was noticed shortly after that the whistle which was heard on the port bow had crossed to starboard. He stopped the engines at about 1.48, Montreal time, and, when he thought the ship had lost her headway about two minutes later, he sounded two prolonged blasts. After sounding that signal three times he put his engines full speed astern, and sounded three blasts quite a few times. At that time the Bengore Head appeared to be about four points on the starboard bow, and when her main masthead light came in view she was bearing six to seven points on the starboard bow, about 300 feet off.

When giving the various orders, he conferred with the pilot, who agreed with him. About a minute after sighting the main mast light the ships collided at an oblique angle, and remained fast together about two or three minutes. When free, the Batiscan sheered around to starboard. Boats were swung out. He stood by the Bengore Head until 6.30 a.m., Sydney time, when he proceeded to Quebec, after ascertaining that she needed no assistance. Testimony of the officers, pilots, lookouts and wheelsmen corroborated these witnesses in the main details.

In summing up, the judgment finds the precautions and navigation measures taken by the Bengore Head to be the proper ones. It finds in Captain Green's evidence a multitude of conflicting statements, the scrap and officer's log books contradicting his deposition to a certain extent unless the incidents were not properly entered. For these reasons the court could not accept his version.

The Commissioner found it unbelievable that the course was maintained as given. The position off Cape Dog when the Batiscan passed was purely problematical, as no bearings were taken. From there a course was shaped S W ¼ W, and whilst steering that course Cape Salmon fog horn was heard right ahead, and the ship kept on that course, going at eight knots over the water. No pilot or shipmaster would keep on steering straight for a point of land, especially in a fog, when the exact speed of the ship and the current was unknown.

Theory of Court

The court's theory was that, finding themselves too close inland at that stage, the course had to be altered. Then the whistle of the Bengore Head was heard half a point on the port bow. As the course of the Batiscan was changed, it brought, gradually or rapidly, the Bengore Head on the starboard side. In the meantime several "two blast" signals were given by the Batiscan, which, in accord with this theory, meant "I am going to port," or "starboarding my helm."

The court did not believe that a shipmaster in his proper senses would sound two prolonged blasts when his ship was still going at some speed through the water. They were taken as prolonged blasts by the Bengore Head, because they were not sounded short, but long, indicating the feelings of apprehension of those on the Batiscan. The hearing of these sounds could not change materially, or appear to change to those on the Bengore Head. They had them constantly on their port bow, and assuming, as they did, that they were prolonged blasts, they were justified in keeping their course and putting their engines slow ahead, and porting slightly in order to bring those sounds abaft their beam.

"When the ship appeared in sight a porting helm must have taken place on the Batiscan, as if such had not occurred the impact would have been at right angles. The examination of the damage to the Bengore Head, especially on the main deck, indicates that the Batiscan struck at an angle of 45 degrees, and this could only be done with a port helm, and the effect of full speed astern. The damage also indicates that the Batiscan had considerable way on her when she struck, which makes our theory possible respecting the two-blast signals.

"Upon examination of the damage to the Batiscan, we noticed that the bow plates were rolled over to port, also part of the works. It could not be otherwise. The Bengore Head had some way on her, and naturally under such impulse it is evident that no other result could be effected.

After further analysis of the damaged plates to reconstruct the scenes which preceded the collision, the judgment continues:

"If what we have outlined did not take place, the fact remains that Captain Green, by his own evidence, stands in default; that he acted in a careless manner, and has shown poor seamanship. The pilot, according to the evidence, seems to have agreed to all suggestions made by the master as to evolutions prior to the collision. If it had been proven that he objected the court would have taken same into consideration.

"Another point we wish to make is that, when the collision took place the engines of the Batiscan should have been put at stop, in order to remain in the wound inflicted, till it was found that the Bengore Head could remain afloat. In separating, Capt. Green again performed an action which entails censure."

In giving its finding, as already indicated, the court laid special emphasis on the fact that the condition of the damaged hull and cargo of the Bengore Head demonstrated that the Batiscan had considerable way on her in spite of the evidence of the master that his ship had sternway to the extent of two knots. In view of that, his sounding several times of two prolonged blast signals was a wrong signal when his ship still had headway. He had admitted that the telegraph remained at full speed though the speed was less owing to the reduction of steam. He had not obeyed article 16 of Rules of the Road requiring a ship to stop her engines and navigate with caution when hearing the fog

signal of a vessel apparently forward of her beam.

Counsel for the Bengore Head, F. E. Meredith, K.C., in his address to the court, criticized in a forcible manner the instructions, or sailing directions, issued to the master of the Batiscan, Captain Green, by the charterers of that vessel; but after consideration the court determined that it was beyond its jurisdiction to comment on such, other than to say that it behoves those interested to unite and discuss the possibilities of formulating instructions which will leave no room for wrong interpretation.

Captain Murray's reasons for not concurring in the decision with regard to Pilot Raymond was that the latter had been told the vessel was sinking, and he had been man enough to say he would never leave a boat in such a way again.

S S. "SILVER WINGS" WRECK

JUDGMENT was rendered on August 30, at Halifax, N.S., by Acting Wreck Commissioner, Lieut.-Commander Graham Holloway, R.N.R., following an investigation as to the cause of the wreck on Sable Island on August 17 of the British steamer Silver Wings. The master's certificate of Edward O'Toole was suspended until August, 1916, a recommendation being made, however, that he be granted a mate's certificate until that date. The certificate of the mate, Thomas Jones, was suspended until November 30 of this year, without the option of a certificate of lower grade.

The Voyage Before Stranding

The British steamer Silver Wings, on her way with grain to Archangel from New York stranded at 11.30 p.m. on August 17, at the western end of Sable Island during thick weather. The master did not have his compasses adjusted to ascertain if the part cargo of steel rails had affected his compasses. Deviations were taken on three courses, but as the captain had lost his deviation book, scrap log book and chart, they were not produced in court. Neither the master nor the mate could tell what the deviation had been on easterly courses before loading the rails, and the court was, therefore, unable to state whether the carrying of steel rails on deck had affected the compass or not. It was felt by the court that there had been plenty of time to save the books above mentioned.

For three days the weather was thick, but no soundings were taken, although the ship was constantly in sounding waters. Even though the captain steered to pass Fire Island vessel and Nantucket Light vessel, and did not hear the fog whistle, he changed his course without sounding. While suspending the captain's certificate for a year for not using the lead and for reckless navigation, the court recommended that he be granted a mate's certificate during that period. The court referred to him as obviously a man of ability.

The suspending of the mate's certificate as master for three months, without the option of a lower grade certificate being issued, was because he did not realize the responsibility of his position as mate. He showed only the compass course on the log, displayed no interest in the navigation, and took over his watch without checking off the ship's position.

No Second Mate Aboard

The court made the following additional comment: "The Silver Wings left the United Kingdom with only the master and mate holding certificates; when the second mate left, shortly before the ship sailed, the boatswain was made chief boatswain (the Court do not realize what this term implies), and kept watch. The owners, according to the master's evidence did not detain the ship for even a day to endeavor to obtain a second mate, nor did they send a man out as a passenger to catch the ship in New York; the court hazards the opinion that if the two officers had been carried, at least one of them would have realized that his position carried great responsibility and that he was not put on the bridge as a figure head. The court must point out that legally, however, for her tonnage, she had the full complement, and the master and mate are alone to blame.

The court found that the type of log book kept on the steamer Silver Wings was not of a class to make the proper entries of ordinary navigation, and recommended that uniform log books be issued by steamship owners where proper entries would be made.

STEAMERS IN AND OUT OF MONTREAL

UP to the end of August, 514 vessels were registered inwards at Montreal, as compared with 612 last year for the same period. Outwards the Customs books show 568 vessels, being 52 less than passed out last year, according to the books in the shipping office of the Montreal Customs House. The difference of fifty-four between the inward and outward figures for this season is explained by the fact that coasting vessels passing through Montreal to some inland port are not entered inward, but when these vessels pass out again from some American port, like Oswego, they are entered outward from Montreal.

The difference between this year and last year is mainly a matter of grain boats. There were very many vessels here last year to take away the great surplus of grain, but this year the grain was cleared away quite quickly and the vessels for the fall crop are not yet needed, as the first new wheat from the Canadian West has yet to come. New crop American wheat is already in the elevators. There are fewer colliers and coasting vessels as well.

TRIPLE AND QUADRUPLE SCREWS

TWIN, triple and quadruple screws are at present employed for the propulsion of large battleships. In the United States Navy there are several Dreadnoughts with twin screws driven by reciprocating machinery, whilst several large German and French warships are driven by three screws. The British practice is to have quadruple screws.

Several considerations are taken into account when the number of screws are decided upon, such as the total power to be distributed. When this is not excessive, either triple or quadruple may be adopted, and the question of the propulsive efficiency of these systems is then, amongst other things, taken into consideration. From experiments made in the Spezia tank it appears that higher efficiency may be looked for from a triple arrangement than from quadruple screws. Four screws have several disadvantages, amongst them being an increase in resistance due to the appendages of the shafts and a smaller utilization of the wake. In a triple-screw ship the centre propeller is placed most advantageously for making use of the wake, whereas in quadruple screws the wing propellers are placed far out from the centre line and are thus in a position of inferiority. It has also been shown by experiment that considerable interference is effected by the propeller race from the forward pair of screws upon the wake of the after pair in a quadruple arrangement.

In triple-screw warships driven by turbine machinery the distribution of power is equal and the three screws are generally of the same dimensions. In triple-screw merchant ships, fitted with the combination type of machinery, two large screws are placed on the wings and a small screw, driven by the turbine, is placed in the centre position. It is most important from the point of view of propulsive efficiency that too much power should not be passed through the small centre screw, as although the wake value is high, the propeller is generally too small to use the power efficiently. Although experiments indicate that triple screws are more efficient than quadruple, high propulsive efficiencies have been obtained with both arrangements, the triple-screw light cruisers being very efficient, as also were the quadruple-screw battle cruisers of the Invincible type.—"Shipbuilding and Shipping Record."

SHRAPNEL SHELL PRODUCTION IN A SHIPBUILDING AND MARINE ENGINEERING PLANT

Staff Article

The sudden call from the manufacture of articles of a peaceful commerce to that of supplying the gods of war with provender of a prodigious amount and such as we never dreamed of producing, has been met by the administrations of our iron and steel industries in a manner that demands our whole-hearted admiration for their enterprise and resourcefulness. This particular plant is now making arrangements to manufacture 4.5 high explosive shells.

FROM building ships to making shrapnel shells represents somewhat a switching between extremes, and naturally called for changes in and additions to equipment. At the plant under review, however, little difficulty was experienced in finding room for a shell department which would not interfere with the ordinary work. A portion of the ground floor of the machine shop was taken over for the purpose and equipped with the necessary machinery. The floor or gallery above was also utilized for the making of shells. The heavier tools are installed on the ground floor and the operations up to and including the finish turning are done there.

On the gallery above, a banding press and band-turning lathe, a socket finishing lathe and a milling machine represent the machines installed, the greater part of the space being devoted to the assembling, painting and other hand operations, and to the housing of the inspection department. The entire plant is laid out so that the shells start at one end and are handled progressively until finished. "Chapman" elevating trucks distribute the shells between the various operations. Cutting compound supplied by the Cataract Refining Co., Toronto, Ont., is used exclusively on the various cutting tools. The heat treating department is located in a separate building outside of and adjoining the machine shop. This arrangement helps considerably in keeping the latter cool and free from fumes.

Although not among the first firms to undertake the manufacture of shrapnel shell, good progress has been made and little time has been lost in getting to the shipping stage. A number of "short cuts" and time-saving appliances have been introduced to increase production. The shops are equipped with electric motors using hydro power, and a spur from the G. T. R. runs through the yard to the machine shop, bringing the forgings right up to the door. The forgings are stored just outside, and the cutting-off machines are located at that end of the shop within a short distance of the pile.

PART OF MAIN FLOOR OF SHELL SHOP SHOWING MACHINES' LOCATION FOR FIRST SERIES OF OPERATIONS.

Cutting Off to Length.

The machining of the shell forging begins at the base, which is cut to length on a cutting-off machine supplied by John H. Hall & Son, Brantford, Ont. The advantage obtained by machining the base first before cutting off the open end is that it gives a square face to work to for the later operation, and also has the advantage of keeping the length of forging in a definite relation to the thickness of base. The machine is equipped with a universal chuck for holding the shell, and a bar stop inside the headstock spindle locates the forging in the correct position. The stop, of course, comes up against the base of the shell inside. On the bed of the machine is a saddle, on which are mounted two cross slides, with holder on each, front and back. The cross slides are operated by a spindle threaded right and left-hand respectively, so that the tools always feed in when cutting. The back tool is set slightly ahead of the front,

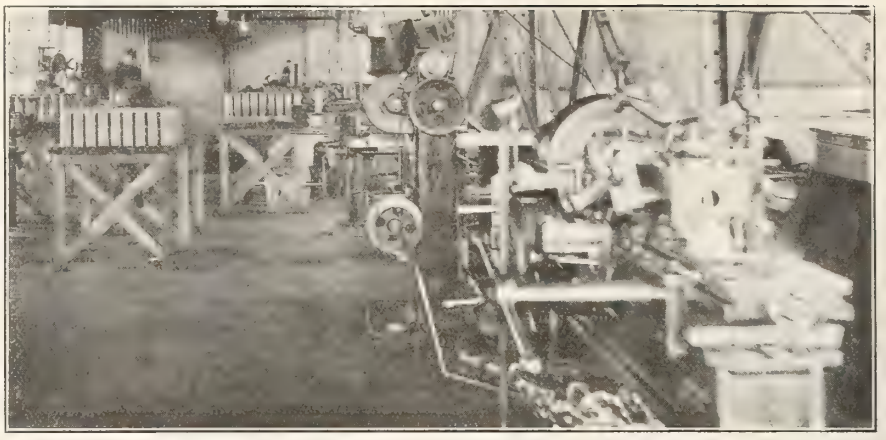
thus allowing a heavy cut being taken off. The hand screw at the right side traverses the saddle longitudinally.

Cutting Off Open End.

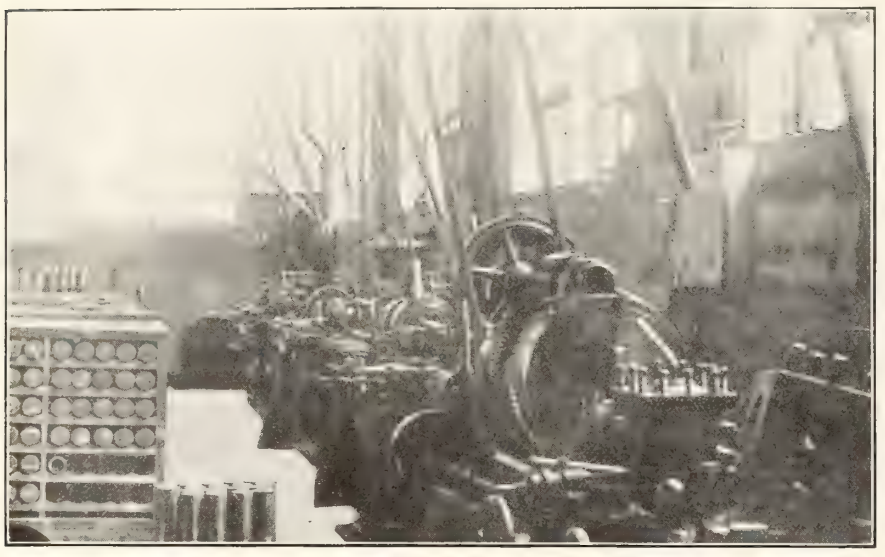
The open end of shell is cut off on the same type of machine as described above, the only difference being a shorter bar stop in the headstock and different cutting tools. The shell forging is placed in the chuck, the base end being up against the bar stop; the chuck is then tightened up. Both tool holders are used as in the previous operation, but in this case the parting tools are set in line with one another, the back tool being inverted to bring the cutting edge central. The shell forging is now the approximate length and ready for the body rough turned.

Rough Turning Body and Facing Up Base.

At the next operation the body is rough turned, the base faced up and corner rounded off, and the body up to the driving band groove finished. Two "Bertram" engine lathes are installed for this work, each being tooled up in identically the same manner. In order to have the outside of forging concentric with the inside, the shell is held on a mandril with a draw-back mechanism. The open end is also gripped in a universal chuck, which rotates the shell by means of a ring attached to the latter by three set screws.

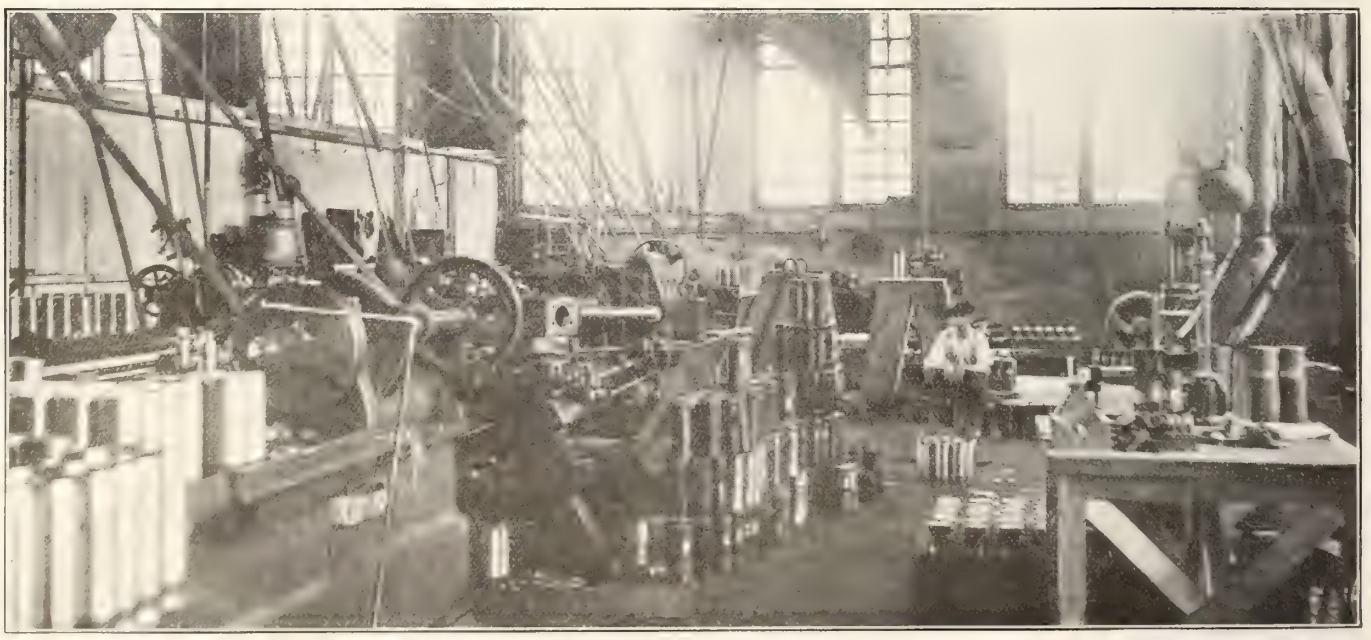


SHELL SHOP GALLERY SHOWING ASSEMBLY.



CORNER OF SHELL SHOP, SHOWING "WAVING" AND FINISHING LATHES.

On the cross slide is mounted a specially-designed fixture for holding the three tools for performing the operation. Two of the tools are set in line with the side of the shell and the third behind the base. The first tool held in an ordinary tool-holder rough turns the body of the shell for a distance of about 7 5/16 in. from the base, leaving the nose bevel to be machined later. The second tool, also at the side, is used for finishing the shell from the base to the driving band groove. This tool is held in a special holder, and can be moved back from the work at the end of the cut. The third tool is a broad cutter so formed that, while the base is being finished, the corner is rounded off at the same time. This tool is, as has already been stated, lo-



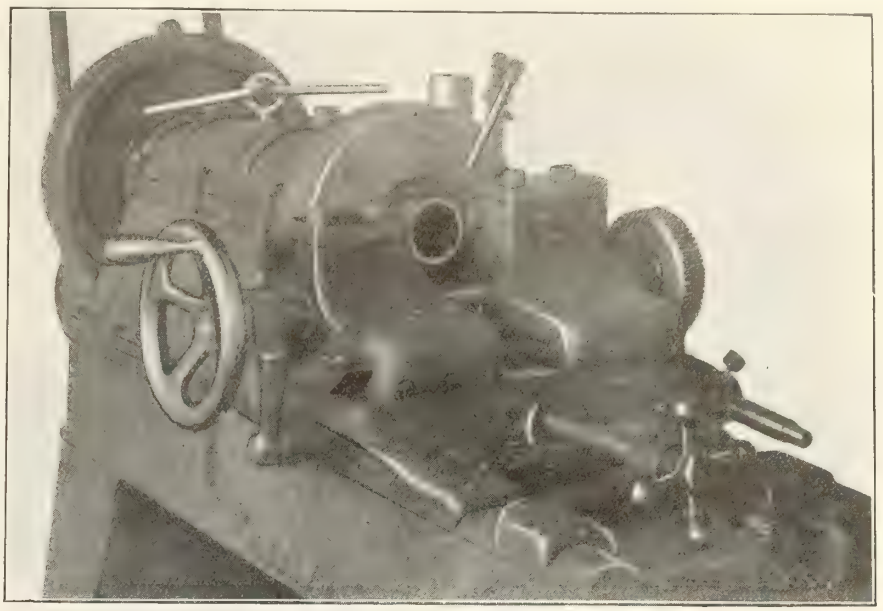
SHELL SHOP, MAIN FLOOR, BEFORE HEAT TREATING DEPARTMENT WAS MOVED TO A SEPARATE BUILDING.

cated behind the base of shell, and is shown at the right in the illustration.

Machining Powder Pocket, Diaphragm Seat and Outside Nose Bevel.

This, the first operation on the inside of the shell, is performed on a "Warner & Swasey" turret lathe, the turret holding the tools for the inside work, while a tool holder on the cross slide contains three tools for machining the outside of nose. The shell is held in a universal chuck, which has a bush inside conforming to the shape of the shell base, and is used for locating the shell in the required position for machining. In this case it is immaterial whether the outside or inside work is done first. The usual method of procedure, and done in order to save time, is to reverse the order for each shell—that is to say, if the nose bevel was formed last on one shell it would be the first operation on the next, with the same rotation for the powder pocket, etc. By this means, one setting of the tools does for two shells. As an illustration the inside boring will be described first.

On the first turret face is a boring bar with a cutter for roughing out the powder pocket and diaphragm seat. The second boring bar has a cutter of similar shape, conforming to the profile of inside base of shell, for finishing the powder pocket and diaphragm seat. The inside work at the base is now finished and the turret is moved back out of the way to permit of the nose bevel being formed. The tool holder on the cross slide contains three tools for rough turning the nose outside and cutting to length. It should be stated that the nose at this stage must be of a certain shape or bevel so that after the closing in operation it conforms to the required profile. The first tool cuts the shell to length, not, of course, the finished length, as this is done at a later operation. The second tool is a taper cutter for forming the bevelled part of nose behind the straight section at the front. This straight part is rough turned by the third tool. This operation is now completed, and when starting on the next shell, the nose bevel is machined first, followed by the powder pocket, etc.

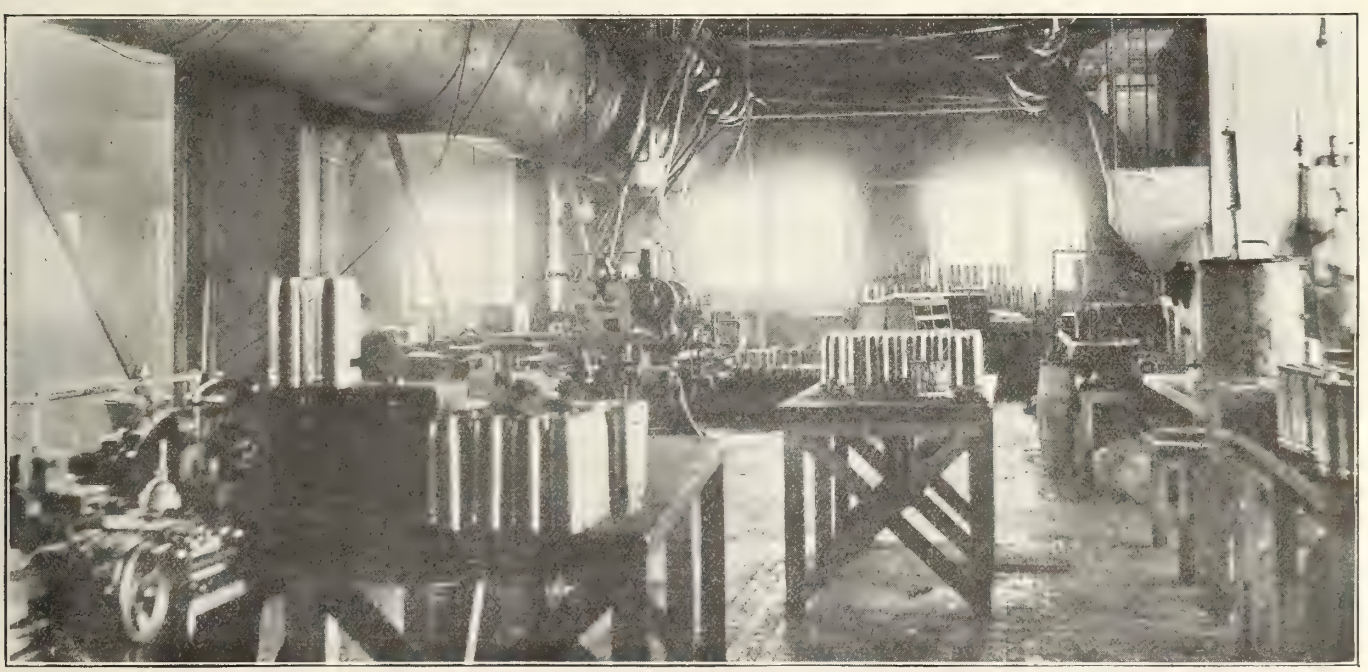


TRIMMING OPEN ENDS AND BASES OF SHELLS.

Waving, Grooving and Undercutting.

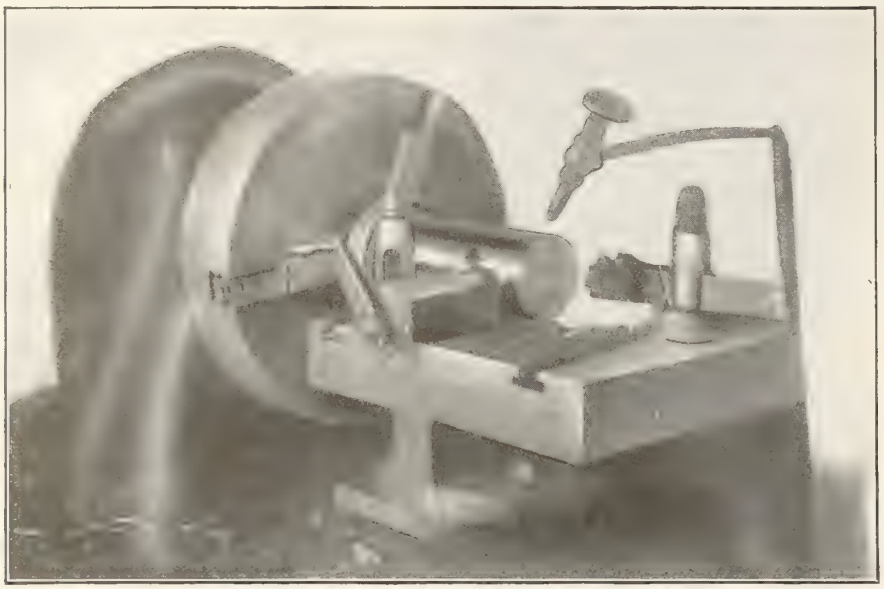
For this operation two engine lathes are installed, built respectively by the Ont., and Flather Co., Nashua, N.H. Both Canada Machinery Corporation, Galt, machines are equipped with a "Bertram" waving and undercutting attachment with a three-point cam, also a bar stop in the centre of chuck for fixing the position of the shell. The nose end of the shell is, of course, held in the chuck, while the base is carried in a cup-shaped revolving centre on the tailstock mandril. The waving and grooving tool is situated in front, while the undercutting tools are at the back. All the tools are cutting at the same time, and the method of operation is as follows:—

The tool boxes are mounted on a fixture fastened to the lathe bed. The front tool is held in a specially-designed tool box mounted on a cross slide, the tool box working laterally in a slide. A



SHELL SHOP GALLERY SHOWING ASSEMBLY AND LOADING FEATURES.

bracket projects from the left-hand side of the tool box, and has a roller which is held up against the chuck cam by means of a strong spring at the right-hand side. The tool itself has a square face for cutting the groove with two



ROUGH TURNING SHRAPNEL SHELL BODIES.

vees for forming the wave lines. The undercutting fixture is mounted at the back, and has two tool holders, each having a hook-nosed tool. The tool holders work in diagonal slides in order to feed in at an angle to form the undercut. The tools are left and right-hand respectively and are inverted when cutting.

The feed is taken care of by cams on front and back brackets fastened to the lathe saddle. The cam on the inside of the front bracket engages with the cross slide of front tooling fixture, forcing the tool in as the saddle travels. The bracket at the back has two cams on the inside face, one for each of the undercutting tool holders. These cams also force the tools in as the saddle travels. The cam feeding in the waving tool operates on the cross slide underneath so as not to interfere with the oscillating motion of the tool box while the wave lines are being formed. This motion is imparted to the tool by the cam on chuck face.

Heat Treating.

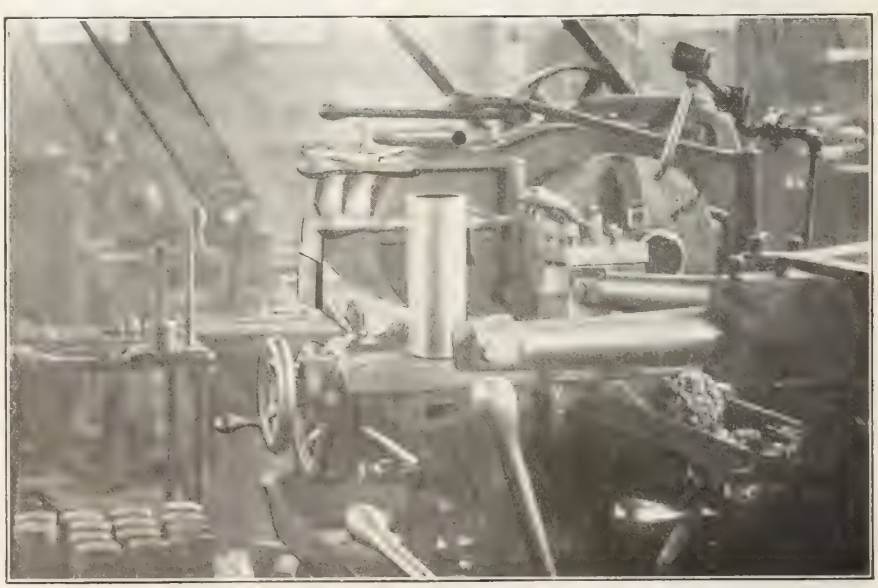
The heat-treating department is in a separate building adjoining the machine shop. In this shop is the nosing press and also the scleroscope testing bench; the apparatus is thus altogether. There are four gas furnaces, not including the nosing furnaces installed—two for hardening and two for the drawing process. One furnace was supplied by the Tate-Jones Co., Pittsburgh, Pa., and the other three were built by the Collingwood Shipbuilding Co. The furnaces are heated by gas and air, no lead pot being used; the air is supplied at 2 lbs. pressure by a "Roots" rotary blower. The oil quenching tank is situated alongside the furnaces, and the oil in the tank is agitated by a belt-driven propeller to keep the oil cool. For the same purpose a number of coils with cold water circulating through them are fitted around the side of the tank on the inside.

The shells on coming from the machine shop are first of all hardened. They are heated in the furnace for about 20 minutes at a temperature of approximately 1,560 degrees Fah. They are then quenched in the oil tank and put on racks on the tank for a short time to dry. The shells are next drawn or tempered to produce the required degree of hardness. For tempering, the shells are heated in a gas furnace for about 12 minutes at a temperature around 800 degrees Fah. They are then cooled down gradually in a place free from draughts, the nose end standing in powdered lime. Previous to the drawing process, the shells are washed in a soda bath to remove the oil which clings to them after being quenched. A pyrometer, supplied by the Canadian Hoskins Co., Walkerville, Ont., is connected to all the furnaces in this department and indicates the temperature in each.

Scleroscope Test.

When sufficiently cool to handle, each shell is tested under a "Shore" scleroscope in order to ascertain the degree of hardness. By this means it is possible to tell the tensile strength of the metal, which should be approximately 80,000 pounds. The connection between the scleroscope readings and the tensile strength is that they bear a definite relation to each other, the degrees of hardness being proportional to the tensile strength of the metal. By keeping the hardness within certain limits it is possible to figure approximately what the tensile strength will be under test. This is definitely ascertained by having a test piece cut out of a shell and sent to a laboratory to be tested out on a testing machine. One shell is selected at random from each series of 120 and a suitably shaped test piece cut out of the shell at that part which has previously been tested on the scleroscope. The test piece is milled out on a milling machine supplied by the Ford-Smith Machine Co., Hamilton, Ont.

Before being tested on the scleroscope, the shells are cleaned on a polishing wheel, at the point to be tested, so that greater accuracy may be obtained in the readings. A number of the latter are taken at different points, the shell being turned round by the operator for this

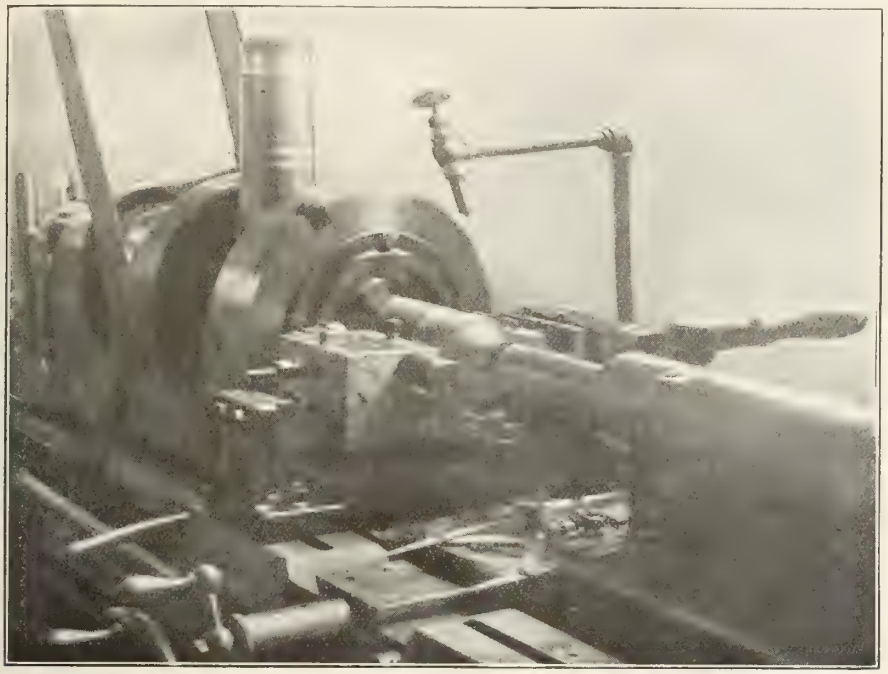


BORING POWDER POCKET AND DIAPHRAGM SEAT, FORMING OUTSIDE NOSE BEVEL.

purpose. All the shells are tested and afterwards arranged in their series.

Closing in Nose.

The nosing press is located in the heat treating department, the furnace being in line with the others and connected to the "Hoskins" pyrometer already referred to. The press was built by the Goldie & McCulloch Co., Galt, Ont., and is hydraulically operated. The lead pot is heated by gas and air, and is beside the press. The nose of the shell is heated to a dull red, then placed on the press, the steel diaphragm having been dropped in. The press is put in operation and the nose closed in by being forced up into the die at the upper end, thus closing in the nose. The shell is now taken off the press and allowed to cool slowly previous to being taken back to the machine shop.



"BERTRAM" WAVING, GROOVING AND UNDERCUTTING ATTACHMENT ON "C.M.C." LATHE.

Boring and Threading Nose, Inside and Outside Profiling.

The next operation consists of rough boring and reaming the nose preparatory to threading, forming inside profile behind the threads, rough turning nose profile outside, and cutting to length. The work is done in the foregoing order. Two engine lathes built by Flather Co., Nashua, N.H., are installed, each being equipped with a turret. After the shell is chucked, the nose is first of all rough bored by means of a cutter fixed in a boring bar held in the first turret face. A reamer now reams out the nose preparatory to threading. The third turret face holds a "Murchey" collapsible tap for threading the nose. The inside profile behind the threads is next formed by means of a forming cutter fixed to a bar held in the fourth turret face. The outside nose profile is then rough turned, a small cutter fixed in a boring bar being used. To obtain the correct profile, a roller is held in a piece projecting from the cross slide on which the turret is mounted. The roller engages with a small cam mounted on a bracket attached to the lathe bed, and, as the tool travels along, it follows the profile given by the cam. The sixth turret face holds a boring bar with a cutter for facing the shell to length.

Finish Body Turning.

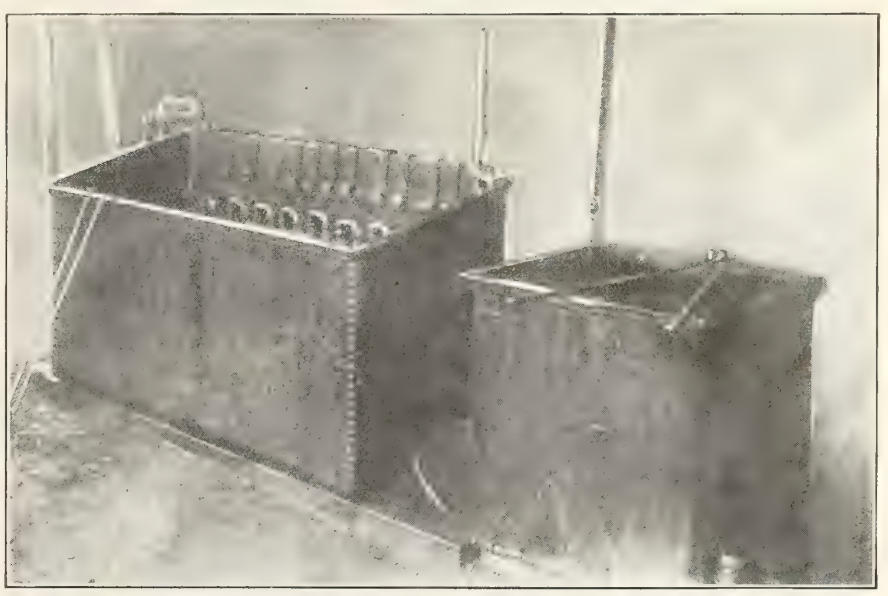
In this operation, a light cut is taken off the body and nose in a lathe and finished on a grinder. The shell is finished from the driving band groove to the end of the nose, the part behind the groove, it will be remembered, having already been finished. Three engine lathes are installed for this operation, two built by the "Canada Machinery Corporation" and one by "Flather & Co." All the lathes are fitted up in the same manner, having the same type of chuck and a forming cam under the cross slide.

The chuck is of special design and holds the base of shell behind the driving band groove. In the nose of shell is a threaded plug for the tailstock centre. A forming cam is fastened to the lathe bed under the cross slide, while a roller underneath the cross slide projects and engages with both faces of the cam. As the saddle travels, the turning tool follows the direction given by the cam, and thus forms the body of shell to the required profile.

The shells are finished on a grinder built by the Ford-Smith Machine Co., Hamilton, Ont., the wheels being supplied by the Canadian Hart Wheels, Ltd., Hamilton, Ont. The base of shell is held in a chuck which has a locating stop for correct position, and the nose has the same plug screwed in as it had when being turned. The shell is ground from the driving band groove to the end of the nose at one operation, the grinding wheel being the same shape as the finished shell profile.

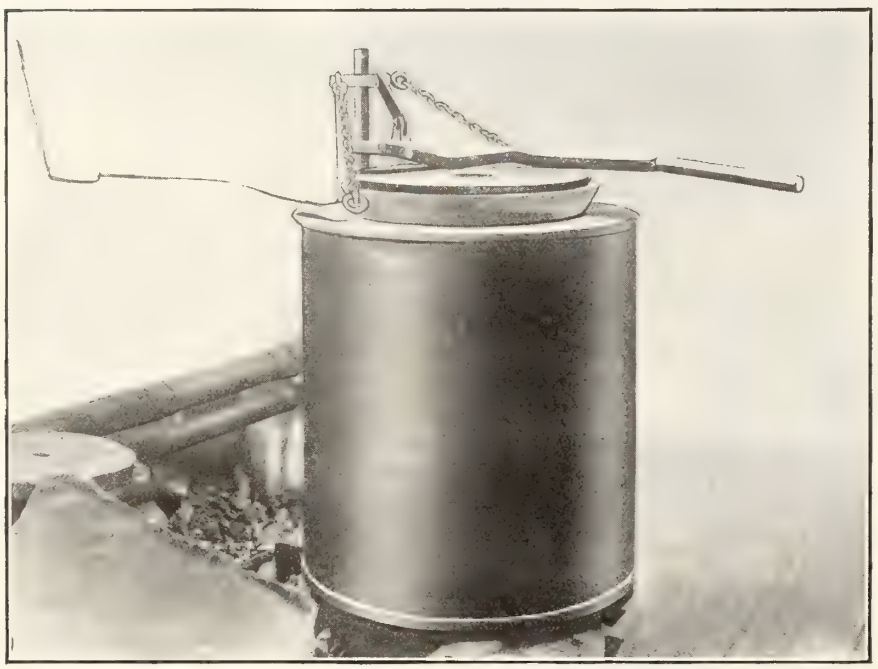
Copper Band Pressing and Turning.

The shells now undergo a preliminary Government inspection preparatory to being taken to another department where the copper bands are pressed on and turned. The banding press was built by the "Goldie & McCulloch Co." and is operated hydraulically at a pressure of about 900 pounds per square inch. The press is of standard design, as used in many shell plants; a full description is,

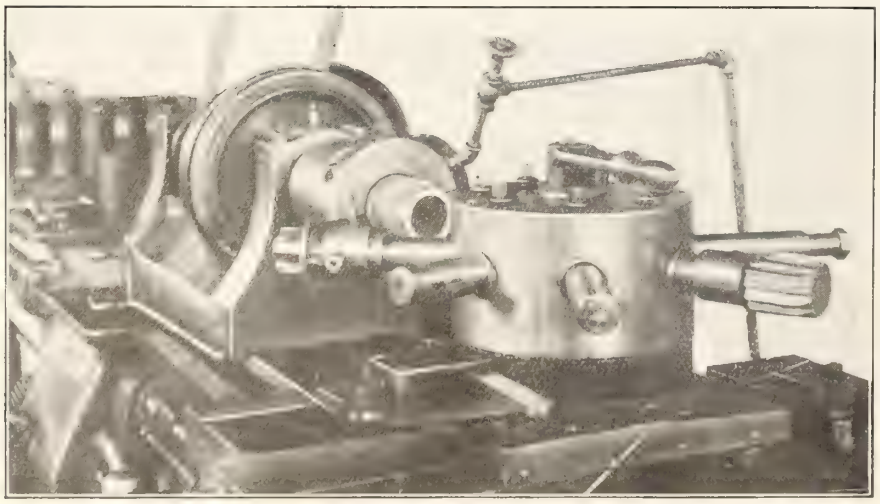


QUENCHING TANK TO LEFT AND SODA TANK ON RIGHT.

INTERIOR OF HEAT TREATING DEPARTMENT.



"TATE-JONES" GAS AND AIR FURNACE FOR SHELL-HARDENING OPERATION.



INSIDE PROFILING, THREADING AND FINISHING SHELL NOSE.

therefore, unnecessary at this juncture. In operation, the copper band is placed in the groove, the shell put on the press, and the pressure applied three times, the shell being moved around slightly after each. The band fills up the groove entirely, and is permanently in position.

The copper bands are turned on a "Warner & Swasey" turret lathe, which also has a cross slide for holding the turning tools. The turret holds a hollow centre which fits the nose of shells up to the shoulder, the centre revolving with the shell. This is the only purpose for which the turret is used. The base of shell is held securely in a collet chuck operated by a draw-back mechanism. The turning tools are mounted on the cross slide. The back tool makes the first cut, and the front tool then deepens the groove in the band, at the same time trimming the band at the edges. The back tool is set very low on the cross slide and cuts the band on the underside while travelling in a horizontal direction towards the operator, cutting the copper band as it passes underneath. This tool is of steel rolled to a special section to give the required form to the band, and only needs grinding on the cutting face to keep the cutting edge sharp. Above the back tool is mounted a gauge which projects over the work, and is used by the operator to place the back tool in the right position. The tool cannot be seen very clearly when cutting; for this reason the gauge, which is set in line with the tool, is used to place the latter in the correct position in relation to the band before beginning the cut. The front tool is set at the ordinary level, and is of special shape in order to deepen the groove in band and trim up the edges.

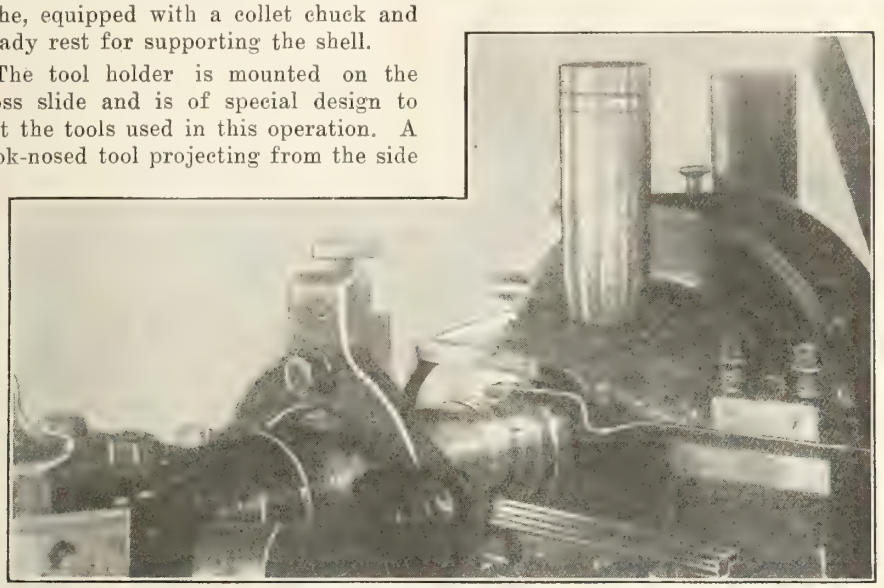
Assembling and Filling Shells.

When the shells arrive in the assembling department they are first of all hand-tapped at the nose. The tin powder cup is then slipped in past the diaphragm in the powder pocket, and the brass fuse tube screwed into the diaphragm. The shell is then placed under an overhead box or hopper containing bullets. The shell when being filled is placed on a mechanical jarring machine, which causes the bullets to settle down or consolidate. After being weighed and having had necessary adjustment made, the shells are taken over to the resin kettle and filled with hot resin, following which they are weighed again. The brass socket is then screwed into the nose, a "Chapman" ball bearing tightening nut being used for this operation. Afterwards the fuse tube is plugged with a small piece of rope, and soldered to the socket by an electric soldering iron.

Finishing Socket.

The brass socket which has been screwed into the shell nose is now finished on the outside, and the fuse seat formed. The sockets when they arrive at the plant are finished with the exception of the outside face. The fuse fixing screw hole has also been drilled and tapped. The socket finishing operation is performed on a "Flather" engine lathe, equipped with a collet chuck and steady rest for supporting the shell.

The tool holder is mounted on the cross slide and is of special design to suit the tools used in this operation. A hook-nosed tool projecting from the side

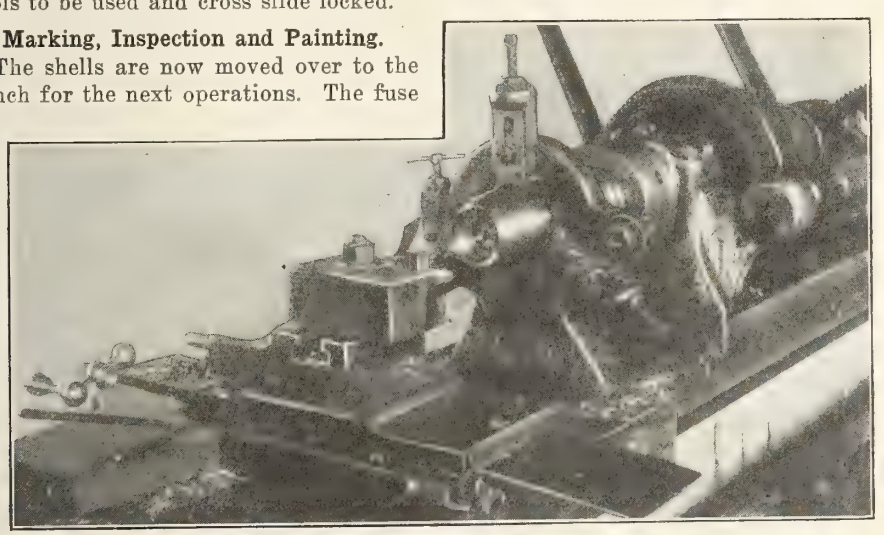


COPPER BAND TURNING.

of the tool holder faces up the end of the fuse tube in the socket, and at the corner of the tool holder on the front face is a small bevelled cutter which forms the socket to the same profile as nose of shell. To the right of this cutter and on the same face of tool holder is another cutter which forms the fuse seat outside the socket. After the end of fuse tube has been faced up, the tool holder is moved back into position for the other tools to be used and cross slide locked.

Marking, Inspection and Painting.

The shells are now moved over to the bench for the next operations. The fuse



FINISHING BRASS SOCKET AND FORMING FUSE SEAT.

tube hole is first reamed out with a "Hisey-Wolfe" portable air drill, and afterwards the socket and fixing screw hole are hand-tapped. The markings are put on by a "Holden-Morgan" marking machine. This is fixed on a bench, and is of the same type as is installed in several other, already described, shell plants.

After being cleaned inside with compressed air, the shells undergo the final Government inspection, during which they are weighed, gauged and carefully examined. They are then passed on to the painting department for the final operation. The painting machine consists of a cup-shaped holder on a bench attached to a vertical spindle under the bench. The spindle has a pulley attached to it, which is driven by a belt from the line shaft. While the holder is revolving, the shell is placed on it nose down and the paint applied by hand. In the centre of the holder is a spindle which goes up the fuse tube and helps to keep the shell steady while being painted. Two coats are applied, the first grey and the final coat black, the nose being painted red. When the shells are dry, a brass plug is screwed into the socket, the threads first being covered with a preparation called "luting." Packing for shipment constitutes the final operation.

OUR SEA POWER TRIUMPH

WRITING in the Daily Telegraph of August 18, Archibald Hurd says:

The sinking of the British transport Royal Edward in the Ægean Sea suggests not the failure but the triumph of our sea power. Not until the war is at an end will the British public realize the harassing burdens which the transport services have thrown on their Navy, which was not planned on a scale corresponding with the liabilities which were suddenly thrown on it in August, to be still further increased when it was decided to land an Expeditionary Force in the Gallipoli Peninsula

The submarine—failure as the blockade has proved—has been an embarrassment. A little over a year ago not a naval officer would, I believe, have contemplated without serious misgivings the various tasks which in the course of the war have been allotted to our naval forces.

Let no one exclaim, Why was not this particular transport better protected? That is the comment of the armchair critic, who, for his own reputation's sake, had better stick to his armchair, and not venture to sea. War consists of a series of incidents, some favorable to one side and some to the other, until the tally is complete—and then the balance is cast up, and the nation which has been the least injured is the victor.

A people which learnt in one day of the sinking of three large cruisers in the North Sea, which heard of the battleship Bulwark and the Princess Irene being reduced to nought by violent explosions, which received calmly the news of the sinking of the Ocean, Irresistible, Majestic, Triumph and Goliath, and did not lose its balance of mind when the Good Hope and Monmouth went down in honor off Coronel will not be dismayed by this latest blow.

It is a success to the enemy, but it represents no such failure to us as can exert any permanent check on our victorious movement against the foe. The ship! What does it matter? The lives? They are irreplaceable. For those who will be mourning in the next few months —after a period of anxious hopes and doubts—for the brave spirits offered up on the altar of the highest cause in which any country waged war, the sympathy not only of the nation but of the Empire will be poured out. They have died for us and those who will come after us.

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THE FUTURE OF DEMOCRATIC LABOR

WHEN Bellamy wrote that noteworthy book, "Looking Backward," he did not enter into specific details regarding previous conditions, the climax of which was characterized as a world cataclysm. Social developments in Britain previous to this war were proceeding at a rapid pace to a point where opposition of a decided nature was beginning to show itself. A complete permeation of society with democratic ideas, such as are evidenced by state insurance and employment bureaus might probably have resulted in that social upheaval or disruption in the mysteries of which Bellamy shrouded his imaginary transformation of human society. The scheme by which each member of society was allowed to pursue the active duties which were most congenial to the individual and of corresponding value to the community, in return for which he was entitled to a sufficiency of life's necessities and luxuries, has had, and always will have a great attraction for those whose effort is to secure for labor an adequate reward.

Attempts have been made on different occasions to put into practice some of the basic principles of socialism. Some have succeeded and some have failed; the failures being partly due to the fact that man is occasionally possessed of ambition, and the "bacillus ambitionis" has decided objection to being levelled down or otherwise restrained from exerting its expansive properties.

Students of current events may perhaps perceive in the present turmoil of affairs, a change in man's attitude to man, the ultimate result of which will be a considerable advance toward that Utopian existence so ardently advocated in some quarters. Germany, as a nation, seems to have had some idea of developing the world on Bellamistic lines, but made the unfortunate mistake of trying to force matters. Her loss will, however, prove to be the world's gain first, and her own gain ultimately.

The great change in society's attitude toward labor is at the present time more strongly evidenced in Europe than in Canada. This is so because of the more acute conditions prevailing there.

Its most important feature is, perhaps, the acknowledgement by society of its absolute dependence on labor, and by society is meant the nation, government, titled and untitled persons, the rich and the poor. When lords and similarly classed individuals get into overalls and do their bit voluntarily because they realize the necessity, it ill befits labor to counteract these additional efforts by wilful abstinence from production.

Canadian labor has shown and will continue to show a patriotic enthusiasm in production, which one would fain believe to be universal in the Motherland. Canadian manufacturers have shown an appreciation of labor's efforts, such as never would have occurred in times of peace, and the chief interest of labor should now be how to maintain that appreciation when peace returns.

It is quite obvious that if the majority of men receive adequate remuneration, they will give adequate service, willingly and continuously, always provided, of course, that not more than adequate profit is acquired through their labor. The experience of the British Government in organizing controlled shops may ultimately be incorporated in legislative efforts which may be epoch-marking, and the indiscriminate mixing of all grades of society which has taken place with the growth of Britain's armies will have an undoubted influence on the future reception of democratic legislation.

While Canada as a younger and distant nation has had to form her national character alone and unaided, the centuries old experience of the Motherland has always been available, and in the readjustment of affairs in the days yet to come, the development of advanced democratic views in all branches of Canadian life, will be not the least interesting result of that spirit of co-operation now so happily existing between employees and employers.

Marine News From Every Source

Point Pelee, Ont.—The contract for the erection of a lighthouse tower has been let by the Department of Marine and Fisheries, Ottawa, to Charles Mattaini, Fergus, Ont., at $8,490.

The Canadian Fairbanks-Morse Co., Montreal, have been awarded the contract for the conveying machinery for the addition to the No. 1 elevator for the Montreal Harbor Commission.

Vancouver, B.C.—The Department of Public Works, Ottawa, will call tenders shortly on the construction of two large sheds on the new wharf. Approximate cost will be $250,000.

Customs Notice. — Steam towing winches are now manufactured in Canada by the Corbet Foundry & Machine Co., of Owen Sound, Ont., and are, therefore, not entitled to entry under tariff item No. 470.

Port Arthur, Ont.—The steamers Turret Cape, Turret Chief and Paliki are to be added to those formerly on the Great Lakes and now doing service on the Atlantic. All were ocean-going vessels before being brought to the lakes.

Newfoundland Sealers.—So many of the Newfoundland sealing fleet steamers have secured contracts more remunerative than seal catching under the present market conditions for seal products that very few, if any, will prosecute that fishery next winter.

Steamer Condemned.—The steamer Helen R., plying between North Bay and the French River, has been condemned by Government officers, and is now laid up at the wharf, North Bay. She failed to carry the necessary lifeboats and belts as required by law.

Submarine Destructiveness.—Lloyd's official report for the quarter ended August 12 gives the loss to British shipping by submarines as 77 vessels. At that fearful rate, says the Wall Street Journal, there won't be anything left of the British merchant marine in 200 years.

Montreal, Que.—After spending five weeks in dry dock at St. John's, Newfoundland, the steamer Polan Hall arrived in Montreal on September 2. In a dense fog the vessel ran into a short cliff, about 100 feet high, just north of Cape Race, and pounded on a rocky bottom for an hour before being relieved.

S.S. "Toronto" Laid Up.—The steamer Toronto, of the Toronto-Montreal division of the Canada Steamship Lines, has gone into winter quarters at the Bay Street dock, Toronto. The steamer Kingston will remain on the route for the balance of the season, giving a triweekly service. She will leave Toronto on Monday, Wednesday and Saturday.

Canal Traffic Drops.—Traffic on Canadian canals this season shows an abnormal falling off. Up to August 1 the total tonnage handled was 4,885,436, as compared with 18,338,216, a decrease of nearly thirteen and a half million. Of this amount over twelve million was registered at the Soo Canal. The Welland decreased by 386,696 tons. The only increases were at the Chambly Canal, 54,559 tons, and the Trent Canal, 2,955 tons.

S.S. "Pretorian" in Collision.—The steamer Pretorian, of the Allan Line, was in collision with the steamer Kansan off the mouth of the Saguenay River on the morning of September 15. Neither vessel was much injured, and both proceeded on their journey as soon as the fog lifted. The accident occurred in a heavy fog. The Pretorian had 198 passengers on board, and an extra heavy consignment of mails.

New Brunswick Shipping Situation.—The announcement has been made that the British deck-load law will not come into operation this year until November 15. This will mean that steamships with summer deck-loads will be able to clear from New Brunswick ports up to November 1 at least. This extension will mean a period of greatly increased activity at St. John. So far this year the summer shipping business has been ahead of last year.

Grain Transport.—American vessels this year as last, will be allowed to carry grain between Canadian ports if there is any shortage of Canadian boats. On account of the large number of Canadian vessels on the Atlantic which were taken over by the Admiralty, many heretofore engaged on the Lakes have been transferred to the ocean service and a shortage is quite possible. It will depend upon the number of ore carriers which can handle grain.

Awards to Seamen—Lloyd's have recently established a fund for making awards to captains, officers, and crews of British and Allied merchant vessels for gallant conduct in cases where the vessels have been attacked by enemy submarines whether the boats or their cargoes have been insured at Lloyd's or not. A cheque for £250 was recently sent to Messrs. Lowther, Latta & Co., in recognition of the gallant fight put up by the Anglo-Californian's staff of master, officers and men.

Halifax, N.S.—Three men are dead as a result of an explosion which occurred on the morning of Sept. 10, aboard the Newfoundland schooner Hiawatha, which was loaded to the hatches with oil and gasoline and was lying at the Bedford Basin pier off the Imperial Oil Co.'s tanks awaiting a favorable wind for sailing for St. John's, Newfoundland. The explosion was caused by the ignition of gasoline fumes when Thomas Farrell, the cook, attempted to light a fire in a stove. Farrell saved himself by jumping overboard. Thirty feet of the wharf to which the Hiawatha was tied was destroyed by the flames.

The Canada Steamship Lines have about twenty per cent. of their vessels serving on the ocean traffic at the present time. While the passenger business of the company, taken altogether, has not been quite up to normal this season, revenue from ocean freight traffic has been substantial. Lake freight rates are high this season, and traffic from the west will be a paying proposition. It is stated that after the interlake season closes a considerable proportion more of the freighter fleet will be transferred to the ocean trade, and in this way a revenue will be maintained during some four months that is usually a blank on the company's books.

Halifax, N.S.—G. M. Cochrane, shipbuilder of Fox River, Cumberland county, is to build three large tern schooners. One vessel is now in frame, and will be launched early next spring. The other two will be launched in the summer or early fall of 1916.

Ottawa, Ont.—It is reported that the Government may turn the shops of the Sorel shipyard into a factory for shells, as well as using a private owned factory there for that purpose. This course has been urged by a delegation of members of Parliament for the district.

C.G.S. "Levis" Being Repaired.—The Government steamer Levis, which was sunk in a collision with the Montreal harbor tug Sir Hugh Allan near Three Rivers last month, has been brought to Sorel. The work of raising the sunken steamer had been proceeding since August 27. She will be repaired in the Government yards at Sorel.

"Saronic" Back on Lake Traffic.—The steamer Saronic of the Canada Steamship Lines arrived at Sarnia on Sept. 18, after being on the lower St. Lawrence for more than a year. She will ply in the freight business between Sarnia and Fort William from now on to the end of the season.

Soo Canal Record.—When the last of 118 vessels and small boats passed through the American locks at Sault Ste. Marie on Sept. 17, all daily records since the opening of the locks had been broken. The number passing through the Canadian locks was not taken into consideration. The largest number previously to this was one day in 1895, when an even 100 craft passed through the Weitzel Lock.

S.S. "Hendonhall" Repair.—The Hendonhall will go into the Levis drydock in consequence of the Davie Shipbuilding Co. securing the contract to repair the bottom of the vessel, which was so badly injured on the rocks last fall. This vessel surprised all voyagers on the river when it was floated recently by means of compressed air, as it had been regarded as a hopeless wreck. There was some doubt among shipping men if the repairs could be done at a profitable figure, but the fact that New York and Montreal firms vied with the Quebec firm to secure the job shows that experts considered it to be worth while. It is a big job, and a very close figure must have been given by the successful tenderers to get the contract.

Transferred to Montreal—The taking over by the English Government for transport purposes of all the larger sized steamers of the Allan, Cunard and Dominion lines is making considerable change in the shipping situation, and is leading to a gradual withdrawal of transatlantic steamers from St. John's. The latest reduction in the service is the discontinuance of the Allan Line service carried on for nearly 50 years between Glasgow, St. John's, Halifax and Philadelphia. The steamers Mongolian, Carthaginian, Pomeranian and Sardinian are to be transferred to the service between Montreal and British ports, and should the war continue until winter, as now seems likely, they will probobaly be on the next Allan Line schedule between Portland and Glasgow.

Heavy Exports Anticipated.—Inquiry of shipping companies brings responses to the effect that there is a big demand for grain for all periods from now to the close of navigation, and that this demand extends to all other classes of cargo as well. That is to say, large quantities are demanded of flour, cheese, deals, and provisions, as well as of manufactured articles of every description. One feature in the export trade, which of itself makes this a remarkable year as compared with all past ones in the history of the port of Montreal, is the export of large quantities of steel in billets, tubes, bars and all kinds of shapes. In previous years it has been rather a case of importing such articles than exporting them. Apples will also commence to move freely about the middle of September. With these cargoes in prospect the various steamship lines look for a very heavy export business this fall.

LAKE BOATS AT SEA

FROM time to time this summer lake boats so large that they could not pass through the locks of the Lachine and other canals, have come down through Montreal in halves to be joined together either in Quebec or Montreal. They were on their way to begin their career as ocean boats. The steamers Binghampton, John G. McCullough, Owego and George F. Brownell, which have passed through the canal in this manner, are operating for the Marine Transport Service between the Atlantic seaboard and the Pacific Coast ports by way of the Panama Canal.

Considerable alterations have to be made in most of the lake boats transferred to the ocean trade. The deckhouses which are on the forward and after part of lake boats have to be placed in the middle on account of the heavy seas which wash over the bow. Such lake freighters as have been loaded through large side ports by trucks from the dock into the ship must have these closed and install derricks fore and aft. From six inches the hatches have to be raised to 18 inches. The rudder and stern post have to be altered to meet the new service's classification requirements.

CUSTOMS RECEIPTS SATISFACTORY

CUSTOMS receipts for the month of August, according to official figures issued by the Department of Customs, Ottawa, amounted to $8,330,604.04. This total is very slightly under that of August, 1914-15, when the receipts showed the result of heavy ex-warehousing of bonded liquors in anticipation of the tariff increase. Very large quantities of imported liquors, it will be remembered, were taken out of bond in an effort to escape the heavier duties which, it was expected, would be imposed in the Finance Minister's war budget. Even with this abnormal collection of duty on liquors, the receipts for August last year exceeded those of last month by only $53,202.50.

The statement for this year is accordingly regarded by officials of the Customs Department as in every way satisfactory. The same is true of the statement for the five months of the fiscal year, as compared with ante-bellum months of last year, and making the same allowance for the ex-warehousing which took place in August. The receipts for the five months of the present fiscal year amounted to $36,731,165.01, as against $37,125,639.92 for the corresponding period of 1914-15.

DECK CARGO DANGERS

IN warning masters of vessels of the danger of carrying deck cargoes insufficiently secured, the British Board of Trade draws attention to the results of official inquiries made recently into the causes of the foundering of two vessels. The first of these was a vessel which foundered in heavy weather in the Bay of Biscay, mainly because its deck cargo of drums of oil, casks of tallow and other fats, weighing 55 tons in all, broke adrift. The oils and tallow made the decks slippery and dangerous to work on, in addition to choking the pumps eventually. In part, the court's report says:

Stowage Feature—Casualty No. 1

"The barrels on deck were stowed on their heads. The court is satisfied that the ship was supplied with the necessary wires, screws and ropes for lashing the deck cargo, and the evidence is to the effect that they were used. The court, however, is of opinion that it is impossible effectually to secure deck cargo of such a nature from shifting, for when heavy seas break on board, the barrels and casks will lift under their lashings, and, by continually working, will eventually break adrift.

"The deck load was not excessive in the sense that it impaired the stability of the ship, but the court cannot but con-

demn the lack of wisdom which leads those concerned to run the risks of carrying such cargoes in winter when fully laden, and severe weather may be expected. In these matters owners might well enlarge the margin of safety upon which the law insists."

Stowage Feature—Casualty No. 2

The other vessel foundered off Rathlin Island, and its general cargo included a deck load of barrels and drums of oil, extracts and syrups. The court reported, in part, that "the immediate cause of her foundering was the fact that the seas poured into the hold through the hatchway in the after well deck, which had become broken through the deck cargo carried there getting adrift and tearing off the covering tarpaulins. This state of affairs was due to the circumstance that a cargo of casks and drums of oil was carried in the after well, notwithstanding that the vessel was loaded to within 4¼ inches of her winter draught and was 4 feet by the stern on leaving Liverpool.

"The court desires to say that this is, in its opinion, a striking illustration of the danger of fully-laden vessels, in winter time, carrying deck cargo, especially barrels and drums of oil, which it is almost impossible to secure effectually, in spaces from which, in the event of it breaking adrift in bad weather, it cannot be jettisoned, or where it is impossible to get at to secure without endangering life and limb."

OCEAN TONNAGE SHORTAGE.

IT is said that an agreement has been reached between the Governments of Great Britain and Canada whereby the former will recognize the urgency of the situation and refrain as much as possible from commandeering ships that are needed for grain. So far as the ocean tonnage is concerned, however, the shortage is by no means so serious as has been claimed in some quarters; but while the passenger service has in some cases vanished, and in general has been reduced to a minimum, there has sprung up in its place a freight service that far surpasses any that Canada has owned in the past. The big liners have been replaced by large freighters.

Investigation has shown that at the present time the Cunard Company has four of these vessels, two of which have already visited the port of Montreal, although under changed names. This fact is also testified to by officials of Lloyds. In this way the absent passenger boats have to a considerable extent been replaced. That the available tonnage to carry grain will compare not altogether unfavorably with past years is illustrated by the fact that while the Victorian, one of the largest of the passenger boats (an Allan liner) could carry only about 4,000 tons of grain, the Monarch (one of the freighters replacing passenger ships) can accommodate between 8,000 and 9,000 tons. So, while the number of ships may be less, the carrying capacity will be much greater than has generally been believed.

LACHINE CANAL TRAFFIC.

DURING the month of August this year, the amount of grain brought through the Lachine Canal was 4,651,079 bushels less than what came through in August, 1914. Returns made public during this month by the canal authorities indicate a falling off in practically every line of activity connected with the waterway. Coal shipments decreased by 36,661 tons, while not a single sack of flour came down the canal last month, as compared with 102,972 recorded twelve months ago.

Tonnage Lower

There were 1,116 trips through the canal last month, fewer by 347 than last year. The tonnage operated was 589,317 as against 780,352 tons in 1914. The passengers carried through the canal and down the Rapids were 20,453, or 8,206 less than in August, 1914. This last total showed an improvement, however, over the previous month. The cargo tonnage last month was 470,930, a decrease of 190,382. The number of trips light in August, 1915, was 369, as compared with 515 in August, 1914.

For the whole season to August 31 the total grain coming through the canal has amounted to 25,008,924 bushels, just 17,222,206 bushels less than for the same period in 1914.

DETAINED SHIPS

THE Board of Trade recently issued a list of British vessels from which seamen and fishermen have been detained as prisoners of war in Germany, Austria-Hungary and Turkey. There are 83 steamers, 5 sailing vessels and 24 fishing craft.

A case has been fought through the British courts turning on whether shipowners were still liable to these seamen for wages or not. The wife of Tom Ben Beal, second mate of the Coralie Horlock, who signed articles for a voyage not exceeding two years at £9 10s. a month, obtained judgment in a lower court for the allotment note of half this amount which her husband had stipulated should be payable to her. The shipowner claimed the loss of his ship on August 4 through being detained at Hamburg, but the plaintiff claimed that her husband had not yet been discharged according to the articles and the provisions of the Merchant Shipping Act.

In the appeal of the owner, heard before Lord Justices Swinfen Eady, Phillimore and Banks, the majority judgment was for dismissal of the appeal. This does not determine the liability of owners for the wages of interned seafarers, but the owners are held to be liable on allotment notes during the period of their internment. It is claimed that the shipowners will carry the case to the House of Lords.

In the case of the Olympic, the crew's claim to wages was disposed of on the ground that the ship received such material damage that she ceased to be seaworthy for so long a time as to make the continuance of the voyage useless as a commercial venture.

In the case of the Coralie Horlock the majority judgment acknowledged that the vessel was prevented continuing her voyage as a commercial venture, but it was not through unseaworthiness.

ELECTRIC v. STEAM SHIP PROPULSION

SOME very interesting figures have recently been published by "Fairplay," relating to comparative trials carried out under equal conditions between two sister vessels, one of which, the Mimer, was propelled by ordinary triple-expansion engines, and the other, the Mjolner, by Ljungstrom turbo-alternators supplying current for two motors geared to the propeller shaft, steam being supplied from cylindrical boilers fitted with Schmidt superheaters. The vessels are 225 ft. by 36 ft. by 15 ft. 6 in., with a displacement of 2,250 tons and a block co-efficient of .66. The speed of both vessels was 11.8 knots on 900 i.h.p.

In the Mjolner the normal output of the turbines is equal to 900 i.h.p., the motors developing 450 h.p. each. These motors drive on to a single propeller shaft through gearing, the reduction being from 800 r.p.m. at the motors to 85 r.p.m. on the propeller shaft. The boilers work under Howden's forced draught, and with 250 ° Fahr. superheat and coal having a calorific value of approximately 14,000 B.T.U.; the coal consumption for all purposes has been ascertained on service to be at the rate of .89 lb. per hour per i.h.p.

Simultaneous trials of the sister vessel Mimer, with triple-expansion engines indicating 900 i.h.p. and the same quality of coal, showed a coal consumption at the rate of 1.54 lb. per hour per i.h.p. for all purposes. In terms of coal consumption, therefore, the Ljungstrom turbo-electrical installation is the more economical by no less than 42 per cent., in addition to which the total weight of the Ljungstrom propelling machinery in the Mjolner, including boilers, is 72 tons less than the total weight of the machinery in the triple-expansion engined Mimer.

ASSOCIATION AND PERSONAL

A Monthly Record of Current Association News and of Individuals Who Have Been More or Less Prominent in Marine Circles

R. W. Hendry, of Hendry, Ltd., has been appointed managing director of the Halifax and Sheet Harbor Steamship Co., Halifax, N.S.

R. A. Spawton, of Halifax, N.S., has been appointed purchasing agent of the Department of Marine and Fisheries at Halifax.

W. M. Guinness, of the Allan Line, Liverpool office, has assumed control of the Glasgow office, succeeding Mr. Martin, recently appointed assistant manager of Canadian Pacific Ocean Services.

Capt. John Manson, for 26 years keeper of Colchester Reef lighthouse, in Lake Erie, and one of the best known residents of Amherstburg, died there on September 20. Captain Manson was 75 years old.

Capt. Henry I. Matthews, died at his home at Lakeport on September 16, after an illness of several weeks. He was born at Lakeport, August 23, 1846. In his younger days he was a lake mariner, and held a captain's certificate. About thirty years ago he started the Lakeport Canning Factory, and had been a director of the Canadian Canners, Ltd.

Dr. J. H. Stephens, a recent medical graduate of Western University, London, Ont., and manager of the University hockey and rugby teams for the past two years, has been appointed Medical Officer of the 70th Overseas Battalion, being organized. Dr. Stephens, who will have have the rank of Captain, was for some time a skipper on the Great Lakes, having had charge of some of the largest vessels in these waters.

A. B. Stanbury, who has been measuring surveyor of shipping for the Port of Toronto since 1908, has resigned. William Evans, inspector of hulls and equipment; John Dodds, James B. Stewart and George M. Arnold, inspectors of boilers and machinery, all of Toronto, have been appointed as officers to superintend the survey and measurement of ships and surveyors of accommodation for seamen at the Port of Toronto.

Collingwood Shipbuilding Co.—The annual general meeting of the Collingwood Shipbuilding Co. was held on Sept. 1. The usual financial statements and balance sheets were presented and we understand were of a satisfactory character, considering the dull period of the first half of the company's year. The following were elected directors: Thos. Long, Toronto; Capt. Alex. McDougall, Duluth; S. H. Lindsay, Collingwood; P. M. Campbell, Collingwood; H. B. Smith, Owen Sound; S. Dyment, Barrie; M. P. Byrnes, Collingwood; T. P. Long, Collingwood. At a subsequent meeting of the directors, the following officers were elected: President, Thos. Long; Vice-President, Capt. Alex. McDougall; Secretary-Treasurer, S. H. Lindsay.

Capt. P. M. Campbell, a director of the Collingwood Shipbuilding Co., died at Collingwood, Ont., on September 10, at the age of 69. Capt. Campbell was for many years commodore of the Great Northern Transit Co. fleet, which was later merged into the Northern Navigation Co. He was also one of the founders of the Georgian Bay Navigation Co. Capt. Campbell was one of the original directors of the Collingwood Drydock Co., which ultimately became the Collingwood Shipbuilding Co., of which he was a director up to the time of his death.

W. G. Ross, president of the Harbor Commissioners of Montreal, has been elected first vice-president of the American Association of Port Authorities, which recently met in convention at Los Angeles, California. The next convention will be held in Montreal. This is the fourth annual meeting of the association, last year's meeting having been held in Baltimore. When the association comes to Montreal next September, the members will be entertained by the Harbor Commissioners. The dates will probably be September 11, 12 and 13, or during the remainder of the same week.

LICENSED PILOTS.

ST. LAWRENCE RIVER.

Captain Walter Collins, 43 Main Street, Kingston, Ont.; Captain M. McDonald, River Hotel, Kingston, Ont.; Captain Charles J. Martin, 13 Balaclava Street, Kingston, Ont.; Captain T. J. Murphy, 11 William Street, Kingston, Ont.

ST. LAWRENCE RIVER, BAY OF QUINTE, AND MURRAY CANAL.

Captain James Murray, 106 Clergy Street, Kingston, Ont.; Capt. James H. Martin, 259 Johnston Street, Kingston, Ont.; John Corkery, 17 Rideau Street, Kingston, Ont.; Captain Daniel H. Mills, 272 University Avenue, Kingston, Ont.

ASSOCIATIONS

DOMINION MARINE ASSOCIATION.

President—A. E. Mathews, Toronto. **Counsel**—F. King, Kingston, Ont.

GREAT LAKES AND ST. LAWRENCE RIVER RATE COMMITTEE.

Chairman—W. F. Herman, Cleveland, Ohio Secretary—Jas. Morrison, Montreal.

INTERNATIONAL WATER LINES PASSENGER ASSOCIATION.

President—O. H. Taylor, New York.
Secretary—M. R. Nelson, 1184 Broadway, New York.

THE SHIPPING FEDERATION OF CANADA

President—Andrew A. Allan, Montreal; **Manager and Secretary**—T. Robb, 218 Board of Trade, Montreal; **Treasurer**, J. R. Binning, Montreal.

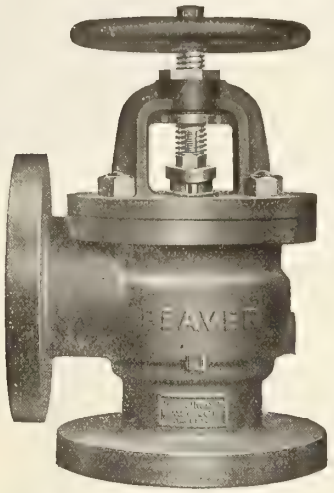
GRAND COUNCIL, N.A.M.E. OFFICERS.

L. B. Cronk, Windsor, Ont., Grand President.
A. F. Hamelin, Montreal, Que., Grand Vice-President
Neil J. Morrison, P. O. Box 238, St. John, N.B., Grand Secretary-Treasurer.
E. Read, Vancouver, B.C., Grand Conductor.
A. J. Ross, Halifax, N.S., Grand Doorkeeper.
James Gillie and A. E Kennedy, Kingston, Ont, Grand Auditors.

1915 Directory of Subordinate Councils, National Association of Marine Engineers.

Name.	No.	President.	Address.	Secretary.	Address.
Toronto,	1	Chas. M. Arnott,	94 Hanley Street	J. S. Adams,	131 Gladstone Ave.
St. John,	2	G. J. McVicar,	49 Winslow St. West	G. T. G. Blewett,	36 Murray St.
Collingwood,	3	Wm. Whipps,	Collingwood, Ont.	Robert McQuade,	Collingwood, Ont.
Kingston,	4	L. E. Spencer,	24 Clergy St.	James Gillie,	101 Clergy St.
Montreal,	5	Henry Lamereaux,	280 St. Andre St.	O. L. Marchand.	378 Clark St.
Victoria,	6	John E. Jeffcott,	Esquimault, B.C.	Peter Gordon,	808 Blanchard St.
Vancouver,	7	W. G. Wooster,	Room 10, Jones Bldg.	E. Read,	Room 10-12, Jones Bldg.
Levis,	8	Michael Latulippe,	Lauzon, Levis, Que.	S. G. Guenard	Bienville, Levis, Que.
Sorel,	9	Nap. Blandon,	Sorel, Que.	Alf. Charbonneau,	Box 204, Sorel, Que.
Owen Sound,	10	John McLeod,	570 4th Ave.	J. Nicoll,	714 4th Ave. East
Windsor,	11	Alex. McDonald,	28 Crawford Ave.	Neil Maitland,	921 London St., W.
Midland,	12	Geo. E. Wilson,	P.O. Box 204	Roy N. Smith,	Box 178
Halifax,	13	Robt. Blair,	29 Preston St.	Chas. E. Pearce,	Portland St., Dartmouth, N.S.
Sault Ste. Marie,	14	Charles H. Innes,	27 Euclid Rd.	Geo. S. Biggar,	43 Grosvenor Ave.
Charlottetown,	15	Philip Bridges,	Stewart St.	Chas. Cumming,	27 Easton St.
Twin City,	16	H. W. Cross,	136 Ambrose St	E. L. Williams	142 Secord St., Port Arthur, Ont.

MORRISON'S
Beaver Angle Valves



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A high-class valve specially designed for high pressure steam. Iron Body, Bronze Mounted, with regrinding or renewable copper disc valve. Seats are renewable and fitted with set screw to prevent their working loose.

Recessed spigoted joint between body and yoke prevents gasket blowing out.

The outlet being under the level of the seat, there is no pocket where water may lodge when valve is closed. Valve body is tapped for drain from pipe line.

The valve is designed to occupy minimum space while keeping full area through every part. Fitted with brass gland to prevent breaking when packing or rusting in when in operation.

Adapted for working pressures up to 250 lbs. per sq. inch.

Hydraulic test pressure 400 lbs. per sq. inch.

Approved and endorsed by Marine and Fisheries Steamboat Inspection Department.

The James Morrison Brass Mfg. Company, Limited
93-97 Adelaide Street West, Toronto, Canada

FORCING THE DARDANELLES

has proved a gigantic task. The Turks said it was imposible, so heavy were the fortifications guarding the land defences, so thick were the mines strewed in the waters of the Straits.

But the impossible is going to take place. The Gates of the Golden Horn are to be opened, and the world will witness the supreme spectacle that crowns a herculean task fought to a triumphant issue.

Our readers and advertisers have been watching this contest in the Eastern Seas with bated breath. It has stirred them in a dramatic way. They, too, are confronted with a great task. They are engaged in commercial warfare to uphold their own supremacy in business.

Forcing the Dardanelles is a timely object lesson. To force it successfully the utmost resources in strength of guns and strategical genius were brought to bear.

And so with business.

Business on a peace footing is rarely successful. Continuous endeavor to meet everchanging conditions, and judicious advertising to promote your sales and affirm your stability, are essential to true progress.

Force, well directed and timely, spells commercial victory. One of the strongest forces known to business science is the ADVERTISING FORCE. Write us about it to-day.

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from small investments. This little advertisement will give you an idea of the use you can make of smal space

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will positively heat feed water to the boiling point without causing back pressure. It will separate oil from the exhaust and prevent a large proportion of ordinary impurities from entering the boiler.

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It is sold under a liberal guarantee of satisfaction or money back. If your engineer is having boiler troubles consult us for the remedy.

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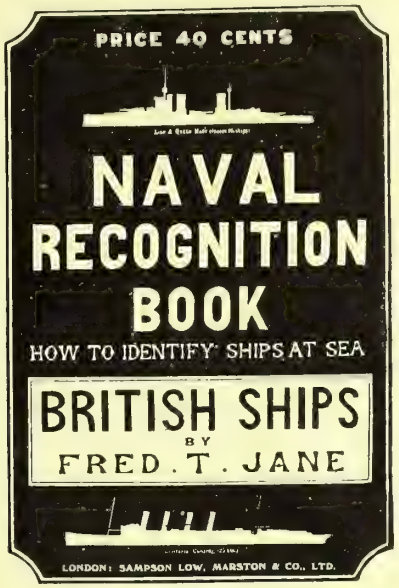

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OR HOW TO IDENTIFY BRITISH WARSHIPS AT SEA

Silhouettes of war vessels in each class are given, together with the names, displacement, speed, and armaments; several maps of important naval bases; details of officers' uniforms, specimens of flags, together with a copious index.

This useful Manual, as may be gathered from its title, is designed to be of assistance to Officers and Men in our Navy and Army, and to Sailors of all ranks in the Mercantile Marine. Also of paramount interest to the general public, especially the section that resides on the coast, and to travellers whose business takes them upon the sea.

Send 20 two cent Postage Stamps for a copy of this book.

Or send us one new paid-in-advance Subscription to Marine Engineering and we will send you a copy free.

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MacLean Publishing Company Limited

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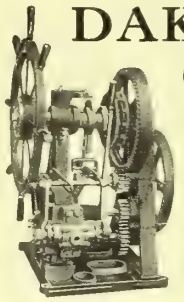

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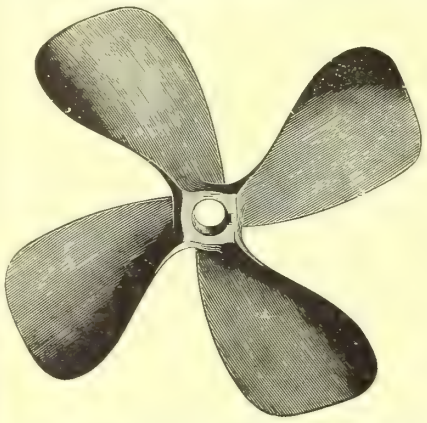

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Life-buoy Lights; Distress Signals for Life-boats; Sea Anchors with Oil Bottles; Compasses; Axes; Bailers; Oars, etc.

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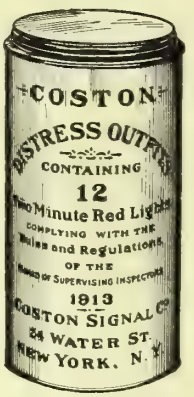
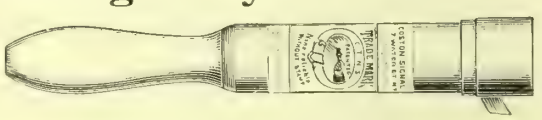


Life-boat Distress Outfits



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MONTREAL, Eastern Townships Bank Bldg. TORONTO 143-153 University Ave. WINNIPEG, 34 Royal Bank Bldg. LONDON, ENG., 88 Fleet St.

Vol. V. Publication Office, Toronto—October, 1915 No. 10

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TORONTO - - CANADA

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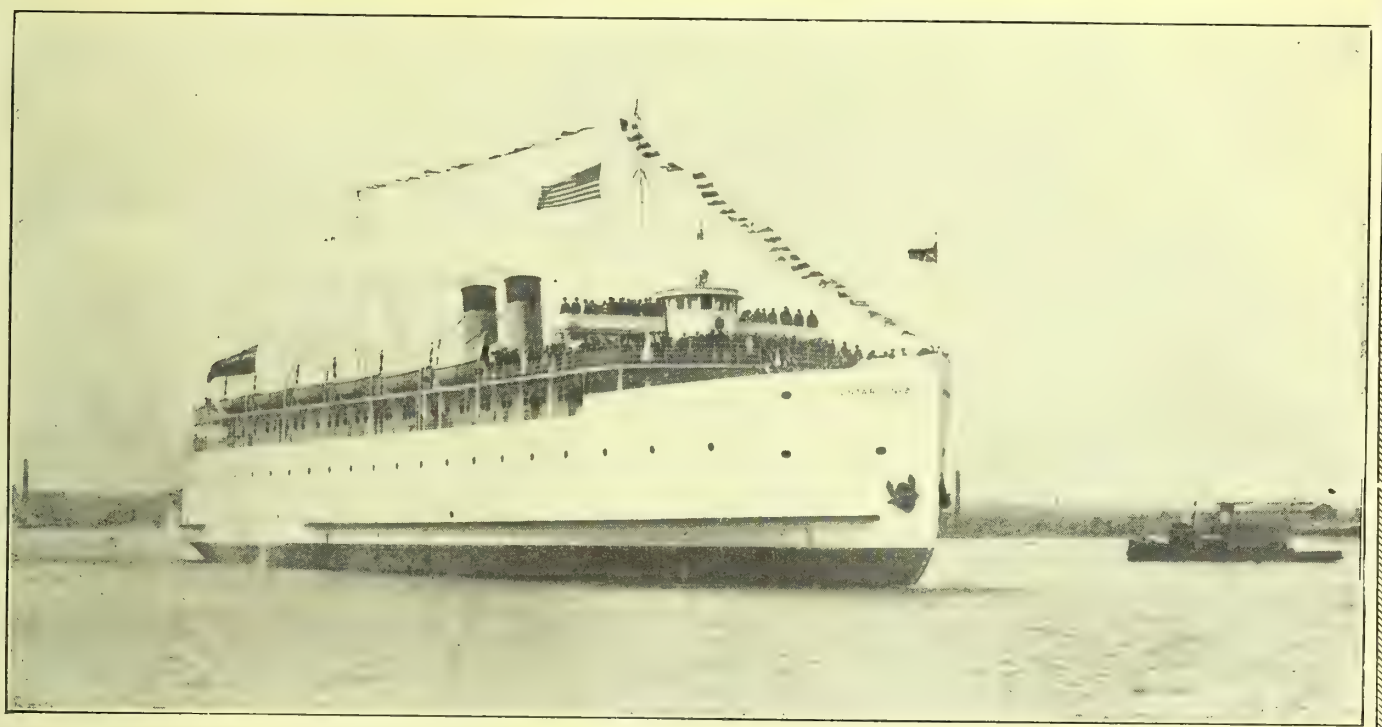

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Capacity 30 loaded cars and 1,000 passengers. Dimensions: Length 318 ft., Breadth 54 ft., Moulded Depth 20 ft. 6 in., Twin Screw, 4,500 H. P.

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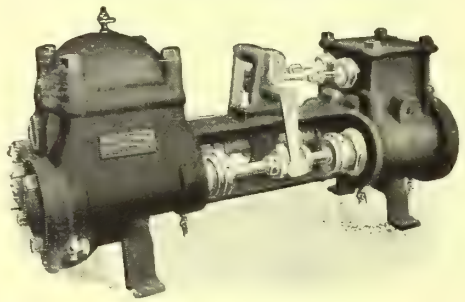
Vertical and Horizontal.



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Create and Maintain Perfect Circulation

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Eckliffs *do* accomplish them. We have the *proofs. Ask* us for them—and for our guaranteed trial proposition.

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Shipbuilders **Engineers**

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Builders of all Types of Vessels up to 20,000 Tons, D.W.
Builders of Reciprocating Engines and Boilers of all Sizes.
Builders of Turbines, Direct-Driving and Geared.
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Builders of Special Self-Discharging Colliers.
Builders of Special Bunkering Craft.
Builders of Special Floating Oil Storage Tanks.

The advertiser would like to know where you saw his advertisement—tell him.

The Publisher's Page

By B.G.N.

The Closing of Navigation

¶ Shipowners, captains, agents and others connected with the tonnage employed on the Great Lakes will watch the barometer and the weather reports very closely from now on till December. The season of closed navigation will soon be here.

¶ The period of *closed navigation* is the time of *open repair work.*

¶ *Somebody must make good the waste of months of storm and stress—WHY NOT YOU?*

¶ You will have a much better opportunity of securing your share of this work if your facilities for handling it promptly are placed before those who need your services, in a journal that reaches all classes of marine men from coast to coast.

¶ When navigation closes, owners will be figuring on their repairs. Be ready for them. Don't let them have to look for you. Make yourself known NOW. You can do this cheaply and effectively by advertising in Canada's only marine paper.

Rate cards on request.

Marine Engineering of Canada
143-153 University Avenue - - TORONTO

Canadian Government "Hopper Barge No. 2" Commissioned

This vessel, one of the first of its type to be built in the Province of Ontario, went recently into service on the St. Lawrence River at Quebec. A diversity of shipbuilding product is a necessary requirement of our national waterways, and how aptly and successfully we are able of ourselves to meet the situation is easily apparent from the description of this vessel and others that have preceded her in our editorial columns. Hopper Barge No. 2 was built, engined and equipped by the Collingwood Shipbuilding Co., Collingwood, Ontario.

SHIPBUILDING in Great Britain and her colonies, as far at least, as the merchant and otherwise peace-time product is concerned, has been allowed to ebb because of war vessel construction and other war time demands. We incline to the belief that rock-bottom in the matter of output has been passed, however, and that the immediately ensuing months will mark a growingly substantial increase in the production of commercial craft and those auxiliaries whose sphere lies in maintaining safe navigable water adjacent to intermediate or terminal ports.

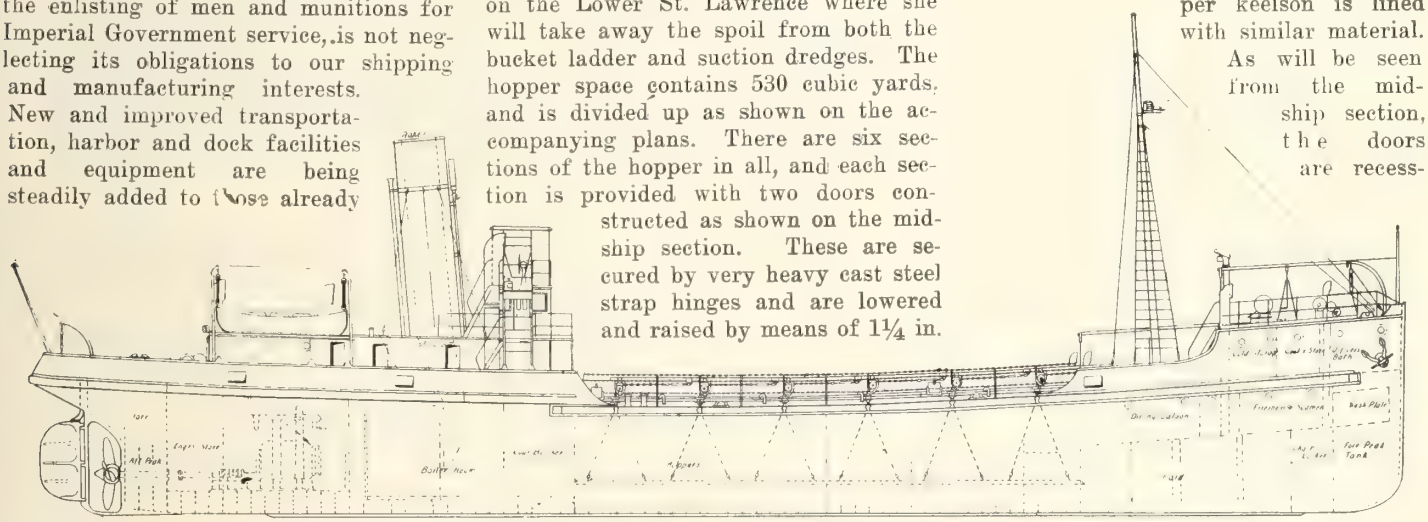
The Canadian Government despite the demands being made upon it from all sides, and particularly that arising from the enlisting of men and munitions for Imperial Government service, is not neglecting its obligations to our shipping and manufacturing interests. New and improved transportation, harbor and dock facilities and equipment are being steadily added to those already existent, and the placing in commission of Hopper Barge No. 2 emphasizes the development taking place in another and equally important direction, the maintenance of the St. Lawrence River ship channel to Montreal.

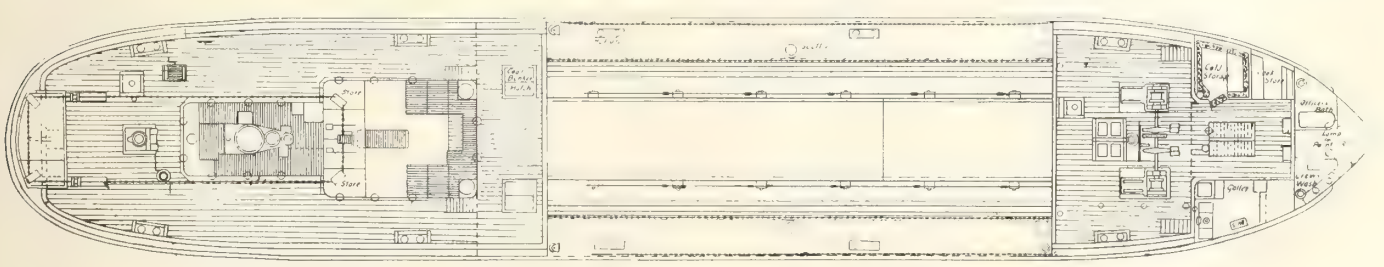
C. G. "HOPPER BARGE NO. 2" ON HER TRIAL TRIP.

Vessel Particulars

Hopper Barge No. 2 is built of steel throughout to Lloyd's highest class, and has been specially designed for work on the Lower St. Lawrence where she will take away the spoil from both the bucket ladder and suction dredges. The hopper space contains 530 cubic yards, and is divided up as shown on the accompanying plans. There are six sections of the hopper in all, and each section is provided with two doors constructed as shown on the midship section. These are secured by very heavy cast steel strap hinges and are lowered and raised by means of 1¼ in. bridle chains, having heart-shaped shackles at the upper end to take up any movement. A chain leads up through the deck casting and over a sheave, and is attached to a strong draw-bar running the full length of the hopper coaming. Two three-fold purchase blocks are fitted at the fore end and a wire rope is led from these on to the drum of a powerful winch situated at the after end of the forecastle.

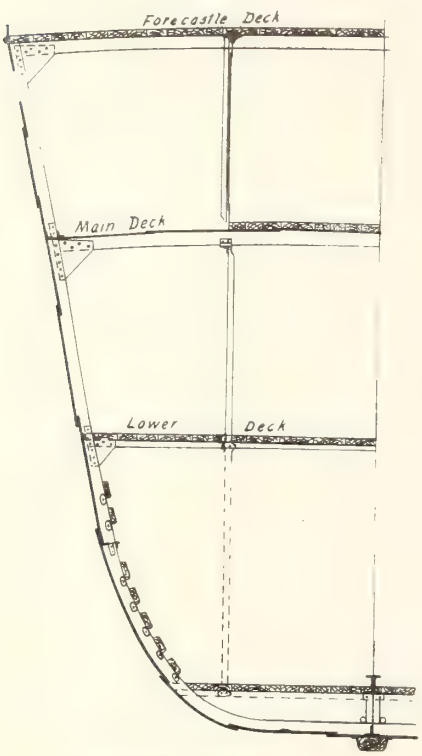
The port or starboard doors can be raised or lowered independently, and any set of doors can be raised or lowered without interfering with the other. When the doors are hove up, they are set by heavy cotters at the deck casting. The doors are made of rock elm and the hopper keelson is lined with similar material. As will be seen from the midship section, the doors are recess-





PROFILE AND DECK PLAN, CANADIAN GOVERNMENT HOPPER BARGE NO. 2.

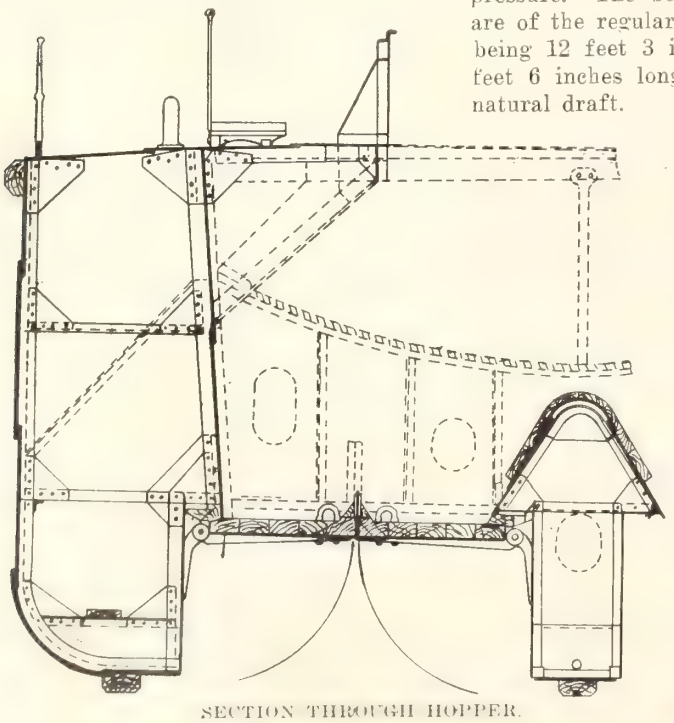
ed well into the hull to enable the vessel to be put ashore at any convenient place and the doors lowered for repairs without projecting beyond the bottom of the hull.



SECTION FORWARD.

Accommodation for fourteen of a crew is provided in a 'tween deck forward, the rooms being spacious, well lighted and ventilated. The vessel dimensions are as follows:

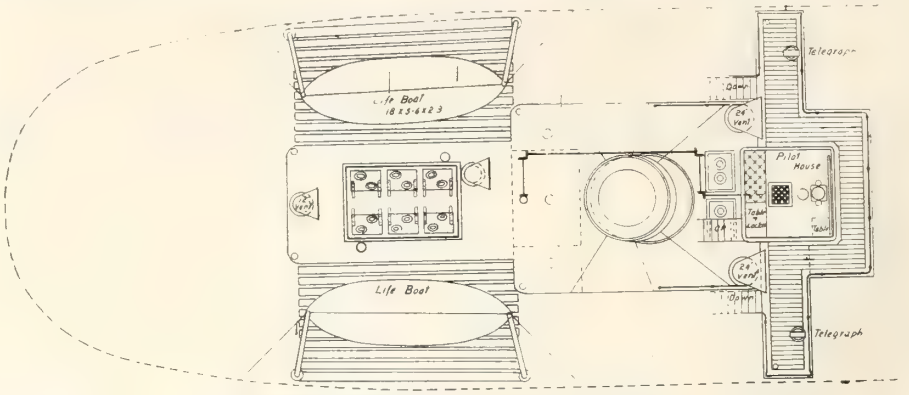
Length, 187 feet over all, 180 feet between perpendiculars; breadth molded, 32 feet; depth molded to main deck, 14 feet 6 inches; depth aft to bottom of grounding keels, 13 feet.



SECTION THROUGH HOPPER.

Vessel Trials

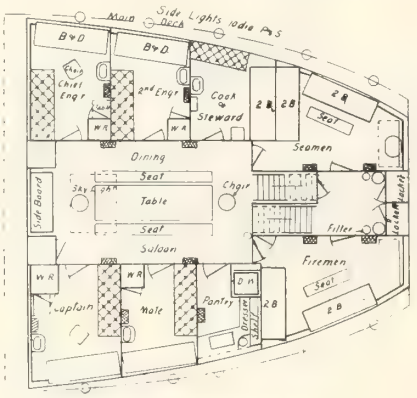
Trials were run on the measured mile at Owen Sound on September 8, on which occasion a mean speed of 8¼ knots was obtained, and on a six hours' trial 750 horse power was developed, the vessel being loaded with spoil to a mean draft of 13 feet. Trials of the dumping gear



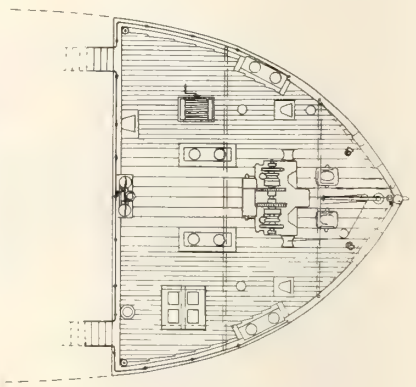
BRIDGE DECK HOPPER, BARGE NO. 2.

Propelling and Auxiliary Machinery

The propelling machinery consists of a set of compound surface-condensing engines, having cylinders 20 in. and 40 in. diameter by 27 in. stroke, and designed to develop 700 indicated horse power at 120 revolutions and 125 pounds steam pressure. The boilers, two in number, are of the regular "Scotch" type, each being 12 feet 3 inches diameter by 10 feet 6 inches long, and working under natural draft.

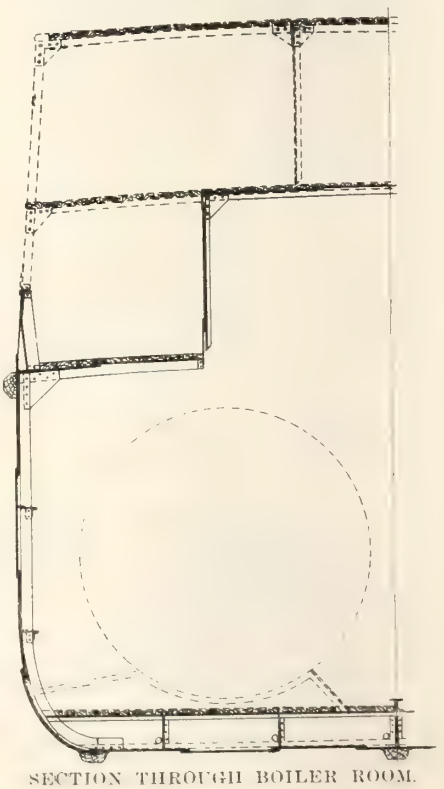


LOWER DECK FORWARD.



FORECASTLE DECK.

A very complete set of auxiliaries are installed, these including "Weir" boiler feed pump, "Gwynne" circulating pump, feed heaters, filters, etc. The installation is such that the vessel can operate in either salt or fresh water. A full installation of electric light has been provided, while the sanitary and heating arrangements are in keeping with the particular type of vessel.



SECTION THROUGH BOILER ROOM.

were carried out later, all of the gear working smoothly and efficiently.

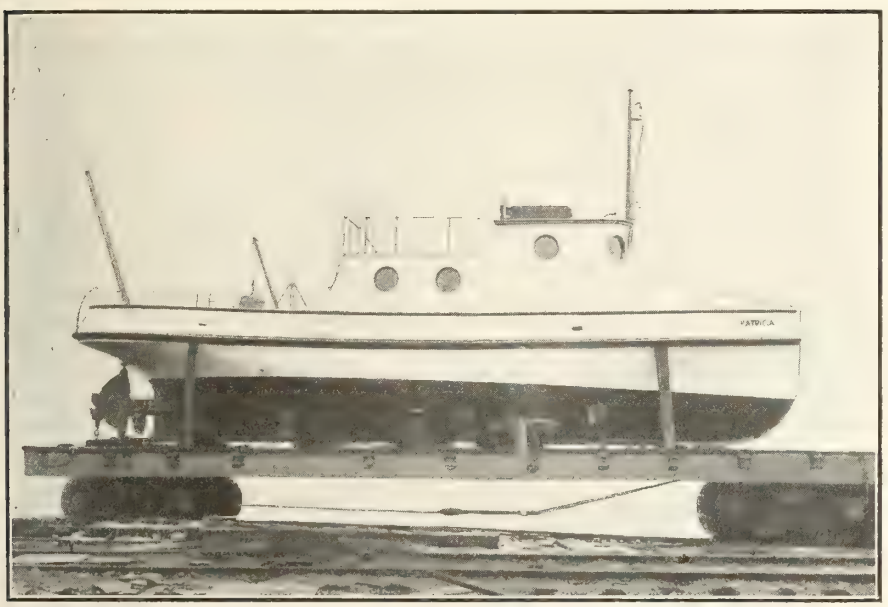
Charles F. M. Duguid, naval constructor of the Department of Marine and Fisheries, Ottawa, witnessed the trials on behalf of the Dominon Government, while John S. Leitch, manager, represented the Collingwood Shipbuilding Co., who built the vessel, her engines, boilers, etc.

Hopper Barge No. 2 sailed for Quebec on September 11, at which port she was taken over according to contract.

TUG AND BARGES FOR HUDSON BAY CO.

THERE were recently completed by the Polson Ironworks Co., Toronto, and shipped to their destination, one gasoline engined tug and the steel work of four barges for service of the Hudson Bay Company.

The tug, as illustrated, was 36 feet long, over all, 9 ft. 6 in. beam molded, and 4 ft. molded depth amidships. The hull was of steel, and the motive power was furnished by a 30 h.p. heavy duty, four-cylinder "Buffalo" gasoline engine.



GASOLINE ENGINE DRIVEN TUG FOR HUDSON BAY CO.

The dimensions of the barges, which together with the tug will be used in lightering work on Hudson Bay, are as follows:—Length over-all, 48 ft.; beam molded, 14 ft.; depth, 4 ft. 11 inches.

CANADA STEAMSHIP LINES

THE record rates now prevailing for the transport of grain, both on the Great Lakes and trans-Atlantic are we understand, having a favorable influence on this year's earnings of the Canada Steamship Lines. It is a matter of common knowledge that the rates at the present time, between the head of the Lakes and Buffalo, Port Colborne and Montreal, far exceed normal rates at this time of the year, ranging from 5½ to 5¾ cents to Buffalo and 5½ cents to bay ports.

Vessel despatch in loading and unloading has been very good. Arrangements have been made for the chartering of seventeen of the company's steamers for the entire winter at rates which are very favorable.

The Quebec Steamship Co., a subsidiary of the Canada Steamship Lines, which operates entirely on the ocean, had benefited by the extraordinary conditions existing at the present time. The earnings of that branch of the company's business, therefore, will be far in excess of any previous year.

BOILLER FURNACE COLLAPSES

By C. E. Stromeyer

SERIOUS and sudden collapses of furnaces are nearly always due to shortness of water, though there have been cases where scale or grease, combined with intensely hot fires, has been the cause, but, as this cannot be known beforehand, it is safest at first to treat all cases of sudden collapses as if they were due to shortness of water. If the water level in a boiler sinks below the furnace tops, they become red hot, and grow so weak that they cannot support the boiler pressure, and suddenly bulge or collapse entirely. Obviously, the most natural counter-move is to cool the furnace plate and thereby strengthen it. This can very readily be done by opening the furnace doors to admit cold air—the fires being left undisturbed, or if red hot they should be covered with green coal—and by easing the safety valves and closing the stop valves on adjoining boilers.

As the single injured boiler, instead of several, is now supplying steam to the engines, violent ebullition will be set up, and, if the boiler is not already quite empty, froth will rise and cover the furnace crowns and cool them. Above all, the rapid discharge of steam through the safety valves and to the engine will quickly reduce the boiler pressure, and either prevent any further mischief being done, or, if a rent should occur, the contents of only one boiler instead of several will be available for doing harm. The feed should also be turned on full bore, but this means of raising the water level is too slow to be of much use in covering the plates if bulging has actually occurred, but it helps, especially if the delivery pipe is above the water level, to reduce the steam pressure, and it minimises the risk of the furnaces tearing.

In cases of shortness of water without furnace bulging, there should never be a moment's hesitation about rapidly cooling the furnace plates. Formerly, it was held that by bringing cold water or froth into contact with a red-hot plate explosive pressures would be generated, but very costly experiments which the Manchester Steam Users' Association carried out on a large boiler have conclusively demonstrated that, even if quite cold feed water is sprayed on a red-hot furnace top, no increase of pressure, but only a decrease takes place. The older view was probably invented in order to account for explosions the real causes of which had been carefully obscured. The steel used for modern furnaces is so mild that it readily stands the test of being heated to redness, quenched in water, and then bent double. There need, therefore, be no fear of cracked plates.

Low-water and high-pressure safety valves, which blow off steam, are fitted to most large boilers, they relieve pressure, and give the alarm as soon as the water level sinks too low. They close again as soon as normal conditions are attained. Fusible plugs are less satisfactory, and should only be applied in small boilers, for, when acting correctly by blowing out in cases of shortness of water before bulging takes place, they put the boiler entirely out of use until a new plug has been fitted, and very often, if they are not properly sealed, they blow out, without water being low. Then, also, if the alloy is not renewed every year its constituents separate from each other and the melting point is raised too high to be of use in cases of danger.

Weeding out inefficient men may help the business, but it doesn't solve the bigger question of what to do with, or for, the men weeded out.

Dominion Wreck Commission Inquiries and Decisions

Following the proceedings of a vessel stranding or collision inquiry is fascinating alike to the mariner and landsman. Much food for thought is always available, and in not a few instances it seems well nigh impossible to reconcile our conception of disaster prevention achievement when confronted with a detailed recital of the circumstances which contribute to many marine tragedies, not only in our own waters but the wide world over.

"SIR HUGH ALLAN"-"DE LEVIS" COLLISION

A FORMAL investigation into the causes which led to the collision which occurred on the 21st day of August, 1915, between the Montreal Harbor Commissioners' tug Sir Hugh Allan and the Canadian Government steamer De Levis, at a place called Point Citrouille, in the River St. Lawrence, was held on the 30th day of September, 1915, in the Wreck Commissioners' Court, Montreal, before Captain L. A. Demers, Dominion Wreck Commissioner, assisted by Captain Charles Lapierre and Captain J. O. Grey, acting as nautical assessors.

The various officers, engineers and men of the two vessels who were on duty at the time of the collision were examined, as well as one of the passengers on the De Levis. F. E. Meredith, K.C., had instruction from the Department of Justice to represent the Dominion Government interests, and render such help to the court as might be called for.

Tug Master's Evidence

Captain Raphael Chevrier, master of the Sir Hugh Allan stated that he held a master's certificate, for a passenger steamer in our minor Inland Waters (No. 5161); that they left Montreal on August 20, at 8.30 p.m., bound for Three Rivers and Quebec, having on board as passengers, the Hon. Robert Rogers, Hon. Mr. Coderre and two others; that the night was clear; that, the usual courses were followed until when off Champlain or a little lower down, he noticed the green light of a vessel westward bound, on his port side, which crossed over to his starboard. Upon seeing this he starboarded his helm in order to have more room to pass; the green light and the Champlain lights were nearly in one. He noticed that the green light suddenly disappeared, and the red light of the oncoming vessel being shown, he therefore hard a-starboarded his helm. His vessel was going at a speed of twelve knots or thereabouts, and he subsequently ordered full speed astern; but the collision happened within a few seconds of this order. He noticed some of the crew of the De Levis on his ship; but was not sure who they were.

The vessels parted from each other, and he ordered the starboard engine ahead; but failed to keep close to the De Levis as that vessel was circling around, her engines going ahead. In the meantime the order to lower the boats was given, which was executed in fairly good time. Men who were seen struggling in the water were picked up, and the rescue of the remainder of the crew and passengers was effected without loss of life. Meanwhile the De Levis had stranded on the south shore.

He was on duty from the time the vessel left Montreal until after the collision, which occurred at 3 a.m., August 21.

The Sir Hugh Allan is a twin screw, steel ship, of 10.37 tons net and 354.23 tons gross, with triple expansion engines, the speed he did not quite know, being anything between twelve and fifteen knots. She carried a crew of 21 all told, and was drawing 13½ ft. aft and 10 ft. forward. She was well equipped with all life-saving appliances.

De Levis' Master's Evidence

Captain J. B. Blais, master of the De Levis, stated that his vessel was wooden built, with twin screws. Her crew totalled 19, and she carried two boats, one small and one medium size,—the latter capable of carrying eighteen persons. Some fifty life belts were also on board.

He left Batiscan carrying the crew of some of the dredges who were going home for Sunday, making 78 persons all told on board at the time of the collision, including the crew and four women. Before rounding Point Citrouille he kept constantly passing well to the northward of the channel, some three hundred fet north of the gas buoy. In order to get the Champlain lights he had to haul more to his right, meanwhile exhibiting his red light to oncoming vessels, two of which he saw, the first one being the Sir Hugh Allan.

Upon seeing the latter, he ported and the collision happened shortly after, but not before the order to stop was given. He then came out of the pilot house on the port side, giving the orders to lower the boats and see to the passengers, when he fell on to the deck of the Sir Hugh Allan, through a space in a broken rail—three feet wide—which was caused by the collision. In falling he hurt his back. He had no look out, and there being no other officer on duty but himself, he was personally steering the ship, while there were three passengers in the wheel house along with him.

The weather was clear and there was no wind. The small boat was first lowered, carrying a few passengers to the Sir Hugh Allan. He returned in the small boat. He admitted that his ship was going ahead after the collision, and made one and a half circles before she stranded. He had tried to steady his helm but found it would not answer. He had been in command for eight years, and held certificate No. 4792, as master of a steam tug boat in Minor Inland Waters. This was his first accident.

Tug Mate's Evidence

The mate of the Sir Hugh Allan, F. Carpentire, the next witness called, produced his certificate (No. 6295) as mate of a passenger steamer in Minor Inland Waters. He averred that he was engaged as mate, not as pilot, and corroborated the master's evidence; but added that he had no sleep from six o'clock the morning before that on which the accident happened. Shortly before three o'clock he took the wheel from the wheelsman, the latter remaining in the wheelhouse. He noticed the green light of a small vessel on his port bow, crossing over to starboard, and thought it was a tug going towards a dredge which was anchored in the vicinity; but upon seeing the red light he knew his surmise was not correct, and operated the wheel according to the instruction he was receiving from the master.

De Levis Engineer's Evidence

The second enginer of the De Levis, Leon Crepeau, stated that he was on duty at the time, the first engineer being in his room; that the moment the impact occurred he immediately left his engine room and jumped on to the deck of the Sir Hugh Allan, without stopping his engines, which were going full speed ahead at the time of the collision, and after. He swore that he saw Captain Blais, the steward, fireman and watchman on the deck of the Sir Hugh Allan, when he looked about.

The first engineer of the De Levis described how, when the impact took place, he was in his room in bed, although awake, and how he succeeded in getting his window opened, went on deck and shut off steam, the engines stopping and the fires being eventually put out.

Other witnesses were examined but failed to throw further light on the casualty.

Finding

The court having carefully weighed the evidence adduced, has come to the conclusion that this collision,—which was

providentially without loss of life, was due to the default of the master of each vessel, involved, failing to carry out Article 26 of the Rule of the Road, which states that when vessels are in sight of each other they shall indicate the course about to be taken by one blast —meaning I am directing my course to starboard, two blasts—to port, or three blasts—my engines are going full speed astern.

Article 25 requiring vessels in narrow waters to keep to their own side of the channel, was broken by the Sir Hugh Allan.

The master of the Sir Hugh Allan had no right whatever in starboarding his helm when he saw the green light of the De Levis crossing his bow from port to starboard, as he was leaving his own side of the channel. He should have hard aported and at the same time ordered full speed astern. Moreover, he must have known, if at all acquainted with the River St. Lawrence, that a vessel going west at that part of Point Citrouille must necessarily show her green light, then in rounding the Point, in order to get Champlain lights in one, the red light must become visible.

The reason given by his mate, Carpentier, who acted the part of pilot, that he thought it was a tug serving the dredge cannot be accepted. It was only a supposition, and such being considered in the light of an uncertainty, precautionary measures should have been adopted either by stopping his vessel,—or what is more in accordance with the rules of the road concerning narrow waters, Article 25, he should have sounded one blast and ported his helm, taking his own side of the channel, which he absolutely failed to do. Instead, at the appearing of the red light which he had brought broader on his starboard bow by starboarding his helm, he continued to starboard, even hard to starboard, without giving any signal of his intention, maintaining his full speed until the collision was inevitable. According to the second engineer, on the stop order being received, the impact occurred almost immediately.

When his attention was called to the statement he had made to the Harbor Commissioners, which differed in many respects with his evidence, he stated that the evidence he was now giving was true, and that the statement made in writing was done in a hurry. As to his work in rescuing the crew and passengers of the De Levis, the evidence shows that he did all that could be done under the circumstances.

For failing to observe the rule of the road, which contributed to the collision, his certificate is suspended for a period of one year; but the court recommends that a mate's certificate for passenger steamers, Minor Inland Waters be issued him. This recommendation is due to his past good services, and to the aid he rendered in rescue work. The mate, who only obeyed the master's instruction, is not found to blame.

With regard to the captain of the De Levis, it is found that he also failed to signal his alteration of course when turning Point Citrouille, and finding the Sir Hugh Allan was constantly showing a green light to his red, the court is of the opinion that he should have sounded one blast indicating that he intended to keep his side of the channel. Moreover, his engines should have been stopped and his ship brought to a standstill when he found the other vessel acting strangely.

The court is astonished to learn that he left his wheelhouse and post without ringing to the engine room the order to stop the engines, and that he found himself on board of the Sir Hugh Allan. The explanation that he fell through a space of three feet due to a broken rail, on to the deck of the Sir Hugh Allan, cannot be accepted.

The collision happened on the port side, and if it was his intention, as he avers, to give orders to lower boats, he would naturally have gone to the starboard side which was uninjured, and allowed access to all parts of the top deck. He also stated that in falling he hurt his back, yet in some part of his evidence he said that if the boats of the Sir Hugh Allan had not been lowered he intended to jump and swim back to his vessel. This contradicts his story of being injured by the fall. By the action of leaving his ship and crew to their fate, he has shown himself unfit to be in charge of a vessel, and in command of a crew.

The court has always adopted stern measures in such cases, and on this occasion will not modify them, and therefore it considers that in the interests of the shipping public, and for the safety of the navigation of the River St. Lawrence, he be relieved from further responsibilities as a ship master, his certificate being hereby cancelled.

We also cancel the fourth-class certificate of the second engineer of the De Levis, Leon Crepeau, who, on his own evidence, abandoned his post to flee on to the deck of the Sir Hugh Allan.

The steward was not called to give evidence, but the second engineer stated that he saw him on the deck of the Sir Hugh Allan. If such be the case, he ,the steward, deserves the epithet applicable in such a case. If the duties of the steward on board of the De Levis are similar to those on board every well disciplined vessel, he should have been at his post, attending and helping the passengers, especially the four women who happened to be on board.

This court wishes to express itself as being absolutely opposed to a system prevailing on small craft of having no one on the lookout, likewise entertaining passengers or anyone in the wheelhouse, entrance to which should be prohibited to all but those who have duties to perform. We also wish to suggest that some system of keeping faithfully a record in a log or journal of movements of these vessels, be inaugurated and enforced. This applies to both deck and engine room.

"PRETORIAN"-"KANSAN" COLLISION

IN a recent judgment, Captain L. A. Deemers, Dominion Wreck Commissioner, intimated that the captain, officers and Pilot Lachance, of the Allan liner Pretorian, could not be held to blame for the collision with the steamship Kansan, of the American-Hawaiian Steamship Co., on the morning of September 15, at a place about one-half to one mile east of the White Island lightship in the St. Lawrence River.

The steamship Kansan had been navigated properly up to the Red Island, but after that he did not believe the courses and distances given by her pilot to be accurate. Under the weather conditions, the speed was too great, and Pilot Wilhelm Langlois did not use all the prudence required of him. Owing to his previous good record the court only fined him $100, payable by November 1. The master and officers of the Kansan, being total strangers in St. Lawrence waters, were exonerated for relying entirely upon the pilot. The court thought the second officer of the Kansan, however, should have made himself acquainted with the various speeds of the ship as well as the error of the compass, and astonishment was expressed at his apparent ignorance of the latter.

Dissecting the "Kansan" Defence

Referring to the cases cited by C. A. Duclos, K.C., counsel for the Kansan, where vessels anchored in frequented channels were held to blame for not slacking chain, or for anchoring in such places, Capt. Demers claimed that there was no analogy between the present case and those cited. The Pretorian was anchored in a frequented channel six miles wide, but in such close quarters to the lightship that other ships would not pass there unless for the purpose of anchoring.

In the case of the Ottawa and the schooner quoted by Mr. Duclos, the schooner had no means at hand to allow more room other than by slacking cable, which would have been effective if done in time. On the Pretorian full speed astern was ordered and executed, but, before the vessel had time to gather momentum, the impact took place. The court felt that the Pretorian did the best she could under the circumstances.

A lookout watch was being kept on board the Pretorian. One man at the bell and an officer on the bridge, as well as a quartermaster, constituted a full anchor watch. There was no doubt that the right bell in the forecastle head was run, although, because of the deceptiveness of sounds in fog it might not have been heard on the Kansan until four or six minutes before the collision, as they stated.

The Course steered by "Kansan"

Relative to the course followed by the Kansan pilot, the judgment said: "Had he steered as he said, his ship would have passed one mile east of the Pretorian.

"His first course from Red Island led straight for the White Island lightship. He allowed half a point westerly deviation, while the mate in his evidence stated that there was eight or nine degrees westerly. The pilot acknowledges that there was a current running in the neighborhood of the lightship from a southeasterly to northerly direction, for which he made no allowance. Although at the time it was the turning point of the tides, the current still ran in the direction above mentioned, and the Pretorian was heading to it at right angles with the White Island lightship head southerly.

"Being uncertain of the courses of the ship, greater care and attention was necessary, and feeling his way was in order. We claim that his speed was too great, though estimated at four knots, for a vessel to maintain when nearing a place of anchorage.

"That he did not hear the bell of the Pretorian until six minutes before the impact we can understand as being possible owing to the atmospheric conditions and also to the fog horn of the lightship being sounded probably at the same time; but having heard the bell six minutes, or even four minutes, before on his starboard bow some two points, he should have brought his vessel to a full stop in the water, and then cautiously navigated till the exact position of the vessel ringing the bell had been ascertained.

"In view of his knowledge of the nature and direction of the current in that vicinity, he must have been aware of the fact that the vessel ringing the bell was heading according to the manner in which it was affected by the current, and likewise as to the effect of that same current on his own ship. If he had, upon first hearing the bell, hard aported his helm and reversed his engines full speed, that current would have drifted him towards the stern of the unknown vessel.

When the Pretorian appeared in sight, a hard to starboard helm was ordered, which was not an improper movement, although a half way star-boarding would, in our opinion, have been preferable, as, in the event of impact, the blow would have been more of a sliding or glancing one, side to side, which would doubtless have inflicted less injury. However, this order in the agony of collision is admissible; but we cannot approve the hard to port order before the vessels were nearly clear of each other. The last order—with the effect of the tide, if any—brought the Kansan's side with full force against the sharp bow of the SS. Pretorian, his own ship therefore receiving the greater injury."

MASTERS AND MATES IN BRITAIN

A RECENTLY issued report on the examinations for certificates of competency in the British mercantile marine and sea fishing service states that the number of candidates passing for foreign-going certificates shows a decrease of 345 on the number for the previous year. That the decrease is mainly due to the war is evident from the fact that the average was maintained until the 31st July last, 1,281 certificates having been issued as against 1,293 for the corresponding period of 1913.

The number of extra masters who passed is 35, a decrease of 23 on the previous year. Ordinary masters show a decrease of 95, first mates 124, and second mates 106 below the figures for 1913. The total number of second mates (760) who passed during the year shows notwithstanding the falling off due to the war, that the number of certificated officers is being maintained, as it is higher than the number for any year from 1905 to 1909 inclusive.

Home Trade

There is an increase of 10 in the passing for home trade masters, an increase of 5 in home trade mates. The average percentage of failures for all ports is 50 per cent. in navigation, and 5 per cent. in seamanship. Apart from the extra master's examination, where a certain standard of signalling in Morse and Semaphore is compulsory, 80 candidates for other grades have passed an equivalent voluntary examination in signalling.

Engineers

The total number of engineers' certificates issued in 1914 is slightly in excess of that for the previous year, and well above the average for recent years. There was a small reduction in the second-class successes, to some extent due to the fact that the number of certificates issued in 1913 was exceptionally high. In the extra first and first-class small advances were made. The returns for the first portion of the year, if continued, would probably have created a record for the twelve months under consideration, but after the opening of the war a decline in the numbers set in, which was especially marked in the last three months. This was due partly to the number of engineers who had entered the Army and Navy, and partly to the conditions of employment both on shore and afloat consequent on the war.

The percentage of failures is the same as last year, viz., 55. Of these 29.4 per cent. in the first and second-class examinations occurred in arithmetic, 17.4 per cent. in elementary knowledge, and 16.4 per cent. in the first-class examinations in drawing. One candidate obtained the second-class certificate for home trade passenger ships propelled by oil engines, and 8 masters and mates passed the voluntary examinations in steam.

The return of the number of fishing certificates issued during the year gives a total of 968, four more than in 1913. Of these 35 passed for extra skipper, 432 for skipper, and 501 for second hand. The percentage of failures, 24.3 per cent., was slightly higher than last year, but the work done by these candidates is on the whole very good.

WASTING OF FIREBRICK IN WATER-TUBE BOILERS

THE wasting away of the firebricks of water-tube boilers depends very largely on the chemical composition of mineral matter in the fuel. The temperatures of the furnaces of these boilers, particularly if chain grates are used, is generally sufficiently intense to soften the firebrick walls. If, while the bricks are in this condition, they should be bombarded with particles of ashes containing much lime, an easily fusible slag would be formed, and the brick surfaces would rapidly melt away. It would therefore be unwise to use coals whose ashes are rich in alkalis unless, and this is usually the case with water-tube boilers, a sufficiently high temperature can be produced in the bed of fuel with a comparatively low draught, so that the mineral matter will melt and trickle down to the firebars instead of being blown away against the brickwork.

If a coal should be found whose ashes consist of pure alumina, lime, or magnesia, these alkalis would not melt in the fire, but would be blown away as dust, and would do serious damage. Such a fuel does not exist, but in fuels the several mineral constituents are not likely to be mixed chemically, in fact, pyrites rich in iron oxide, fossils rich in lime, and shales rich in alumina, exist independently of each other. Under certain circumstances these materials, which are highly refractory as long as they are independent, may under suitable conditions of temperature and draught be carried away and do much harm.

EDITORIAL CORRESPONDENCE

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PRACTICAL INFORMATION ABOUT AUTOMATIC INJECTORS

By S. O. Johnson*

THIS article is confined to the automatic injector, for the reason that it is more generally used at the present time than any other type. By "other type" we refer to what is known as the "positive injector," now almost obsolete, except for locomotive use, where generally very high pressures are carried. The range of the automatic injector, being from about 20 lbs. to 175 lbs. pressure, covers the pressures carried on at least 90 per cent. of all stationary boilers, and being much simpler in construction, has become more popular.

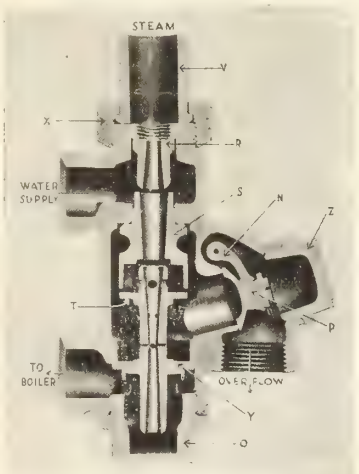
A Delicate Mechanism

Few engineers realize the delicate mechanism of an injector, and as a consequence do not give it the attention they do other boiler appliances needing really less care, but when it is taken into consideration that the variation of a thousandth part of an inch in a drill or reamer used in its manufacture will change its working qualities, some idea may be formed of its delicacy of construction. In many localities, the water used contains much solid matter, such as lime, magnesia, etc., and on account of the heat of the water passing through the injector, this is precipitated and adheres to the tubes, contracting the passageways, gradually but surely, until very suddenly the engineer finds, to his consternation, that his injector ceases to operate. Where such conditions exist, the entire injector should be allowed to stand over night in a solution of one part muriatic acid to ten parts of water. This will dissolve the sediment, which will be blown out when steam is turned on. The practice should be followed every week or two, according to conditions.

In purchasing an injector, it should be borne in mind that capacities are generally based on a lift of about 3 feet and pressures ranging from about 60 lbs. to 90 lbs., and that any condition other than stated changes the rated capacity; therefore, with greater pressure or lift, allowance should be made. It is always advisable to have an injector that will exceed your requirements as to a water supply for boiler, for by throttling the valve in the water-supply pipe the quantity of water can always be graded down to the amount required, and in doing this you increase the temperature of the delivered water to the boiler, which is a saving of fuel. For the purpose of explaining more fully the mechanism of an automatic injector, we present here a sectional view.

Referring to the cut, it will be noted that the entire working parts consist of three jets: (R) steam jet, (S) suction or lifting jet, (Y) combining and delivery jet. For the purpose of examination it is only necessary to remove the plug O, when the jet Y will come out with the plug. The jet R can also be removed by uncoupling the injector from the piping by means of nut X. The jet S is screwed into the body of the injector and removed by a slotted piece of ordinary steam piping.

It will be seen from the above that these jets being interchangeable, it is only necessary for the engineer to send to his dealer for the parts, and he can make his own repairs. The overflow valve (P) is a very important part of the injector, as it must be absolutely tight, but it can always be ground to a seat, in case it leaks, with a screwdriver by simply removing the cap (Z). This injector in its entirety, including couplings and body, has eighteen pieces, and when it is considered that the positive injector in many instances has between fifty and sixty pieces, the advantage of the automatic injector becomes at once apparent.



"PENBERTHY" NO. 30A AUTOMATIC INJECTOR.

Operation of Injector

The operation of this injector is as follows:—Steam is admitted by means of a valve in a pipe attached to the "tail pipe" V through jet R, and passes with high velocity through jet S and out of overflow P to the atmosphere. The water-supply pipe is attached to the injector at the connection marked "water supply," the same having a valve close to the injector, this pipe, of course, leading to a well or other source of supply. The velocity of the steam passing into jet S creates a vacuum equal to 20 in. to 23 in. in the chamber where jets R and S meet. This entrains the air from the water-supply pipe, and atmospheric pressure forces the water naturally to this chamber, when it mixes with the steam and is forced with the steam out of the overflow.

If the proportions of water and steam are correct, the velocity of the steam is imparted to the water and enters the jet Y, which converges to a very narrow space at the centre of this jet. From centre out it diverges, and it is owing to these peculiar tapers and parallels that sufficient energy is given to the water to overcome not only the boiler pressure, from whence the source of supply is taken, but all friction of pipes, elbows, etc., between the injector and the boiler. The water as it passes through this jet draws in the air from the chamber in which it is located, creating so strong a vacuum at the mouth of jet Y, that the automatic valve T flies upward to its seat, and shuts off the communication with the overflow. With this communication shut off, the current must go through the jet Y to the boiler, and, in its rapid passage through jet Y, so strong a vacuum is formed that the overflow valve is forced to its seat by atmospheric pressure, when the injector is working. The valve in the water-supply pipe is for regulating the proper amount of water to the amount of steam. It may be said incidentally that under 70 lbs. pressure this regulation is necessary on a short lift, but above that it is only necessary to open and close the steam valve in starting and stopping the injector, and all the operation of valves and vacuum, as above described, is almost instantaneous. Where the regulation is right, the injector will start without wasting a tablespoonful of water. It may be of some interest to state that taking steam from one boiler at 70 lbs., water can be forced into another boiler carrying 100 lbs. so great is the velocity and surplus energy of the water as it passes through these peculiar tapered jets.

In conclusion, we advise engineers to give more attention to the injector. Do not abuse or neglect it. It is a very important adjunct to a boiler, and will serve you well in time of need. Abuse or neglect it, and you certainly will have cause to regret it.

*President, Penberthy Injector Co.

RAISING STEAM IN INTERNALLY FIRED BOILERS

By C. E. Stromeyer

A VERY large number of boiler accidents, which are not real explosions, and are, therefore, not reported upon, are due to the lighting of fires in empty boilers. The night watchman is not a boiler attendant, and merely does as he has been taught with regard to setting away the fires, and if, as happens now and then, the water has, overnight, leaked out of the boiler, the night watchman may either not know the significance of an empay gauge glass, or may perhaps not feel competent to test it, and to refill the boiler if empty. He will therefore merely do as he has done before, and put away the fires, and when the fireman arrives and finds the boiler empty, the damage will have been done, and the factory will have to be stopped for a day or two while the leaky seams and rivets are being recaulked.

Occasionally it happens that a leakage is started during the period of raising steam. For instance, the blow-off cock may not be tight, or the feed valves may be leaky, in which cases water will at first show in the gauge glasses, but as soon as there is any pressure, leakage commences, and the furnace tops are then exposed to the heating action of the flames.

The resulting collapses are generally of a serious nature because they take place while steam is being generated, and the result is that the boiler in question may have to be kept out of use for one or more weeks. These cases are of the nature of unforeseen accidents, with which night watchmen can hardly be expected to deal, and it is desirable to impress them with the necessity of not proceeding with the raising of steam whenever they notice anything unusual about a boiler, for it is far better to have a delay of a few hours, due to there being no steam, than to have to shut down a factory for days because the boilers have become useless.

Lighting Up

Lighting up after a boiler has been out of use for some time should always be done by the regular boiler attendant, because the opening up of a boiler, its overhauling, cleaning and filling is associated with so many possibilities of which a night watchman is unaware, that he should not be entrusted with the duty of getting up steam for the first time. Pipe and manhole joints may have been broken and not made good again, or not tightly screwed up; safety valves, cocks, and valves may have been overhauled and not properly put together again, etc.

It is clearly too much to expect a man who has had no mechanical training to be able to picture to himself what may be wrong if the boiler under his temporary care does not behave as it usually did. Then, too, there is the risk of causing serious damage to a boiler by too rapid firing while the water is still cold, and many leakages and cracks are directly traceable to negligence in this respect. A temperature increase of 180 deg. Fah. causes steel to elongate one-thousandth part of its length, and as the upper part of a rapidly heated boiler may be 270 deg. Fah. hotter than the bottom, it would be one six-hundred-and-sixtieth of its length longer than the lower part if it were free to move as it liked; but the upper part is linked to the lower part, and both are constrained from adapting themselves to the altering conditions, with the result that stresses are set up which may amount to 10 tons per square inch.

If the customary safe working stress of, say, 5 tons, due to steam pressure, is added to the stresses which are produced by unequal expansion, the factor of safety is reduced from, say five, to less than two, and ruptures are only prevented by the great ductility of the steel of which boilers are now made. In former days, when iron was used, circumferential cracks and seam rips were fairly frequent if steam was raised too rapidly.

Several methods of raising steam may be adopted. The simplest is, of course, to raise steam very slowly. The conditions of heating are then almost the reverse of those to be found with intense firing, when most of the heat passes through the furnace plates and little through the shell plates in the flues. With light fires, this is not the case, for the products of combustion are already relatively cool, and retain what little heat they have even as far as the chimney. They therefore impart almost as much heat to the boiler bottom and sides as to the furnaces, and they thus heat the water in the bottom of the boiler, whereas intense fires would only heat the water which is above the level of the firebars, and the rest would remain relatively cool.

Raising Steam Rapidly

If steam has to be raised rapidly in an idle boiler, and if it is provided with an economiser which is being heated by the waste gases from other boilers, it is, of course, very desirable to fill this boiler with the economiser water, for then the time required for raising the water to boiling point is saved, and the increase of the pressure can be proceeded with more rapidly. Not only in this case, but in all others, it is advisable to open the safety valves while raising steam in order that the steam may blow off freely as soon as the pressure exceeds that of the atmosphere, for there can be no question but that heat transmission is enormously increased when circulation of the water is created by the formation of bubbles. This circulation also materially assists in equalising temperatures.

A boiler, if it is one of a series having no economizer, might be warmed up, as is done in the case of marine boilers, by blowing steam into the cold water, but the necessary appliances are rarely fitted. In such cases, where steam has to be raised rapidly, a very good plan is to nearly fill the boiler with water, and to have bright fires; then the whole body of water above the firebars will grow hot, while that below the furnaces remains cold. As soon as the boiling temperature has been reached, and the open safety valves are blowing off steam, the latter should be shut, the blow-off cock opened, and the lower cold water run out till the lower boundary of the upper hot water touches the boiler bottom. The whole boiler will then be of a uniform temperature, and the raising of steam can be proceeded with at a fairly rapid rate.—From report to Manchester Steam Users' Association.

TEETH OF GEARED TURBINES

SOME interesting details were recently given in a paper real at Liverpool by J. Hamilton Gibson, on the dimensions of the teeth used in important installations of geared turbines. He said it would, perhaps, be assumed that very heavy teeth would be required in turbines transmitting 15,000 h.p. per shaft; that, however, was not the case, for all large powers the standard pitch was only 0.583 in., so that the teeth actually measured less than 5-16 in. thick.

This fine pitch led to smooth running, but the wheel and pinion had to be held accurately in position, and the pinion carefully supported. The teeth were all involutes with a shortening addendum, and large radius at the roots. By adopting the involute form, all gears could be cut with the same standard hob and be pawled out, while the oil clearance could be adjusted by opening or closing the distance between the wheel centres by a few thousandths of an inch. Further, with involute teeth, such an adjustment did not in any way affect the proper meshing of the teeth.

Omemee, Ont.—The Government derrick scow J. B. McColl has recently been busy on the Scugog recently straightening up the lighthouses. Every lighthouse has had a new set of timbers put under it, so that they are all now clear of the water by about a foot.

TESTING THE EFFICIENCY OF LUBRICATION.*

By Alan Flowers.**

THE probability of being able to determine with great exactness the best lubricant for a specified group of conditions, is indicated in a recent paper by Professor Alan Flowers.

The apparatus as now constructed is the result of experiments begun at the University of Missouri in 1909. Fig. 1 is a diagrammatic illustration of the apparatus. It consists of a steam cylinder within which two pistons connected by a piston rod are placed. The space between the two pistons has a constant volume, so that steam admitted to this space does no work on the pistons. Two steam pipes are brought into the cylinder at points just short of the parts rubbed over by the piston, so that oil carried along by the steam may readily reach the rubbed surfaces. An electric motor drives

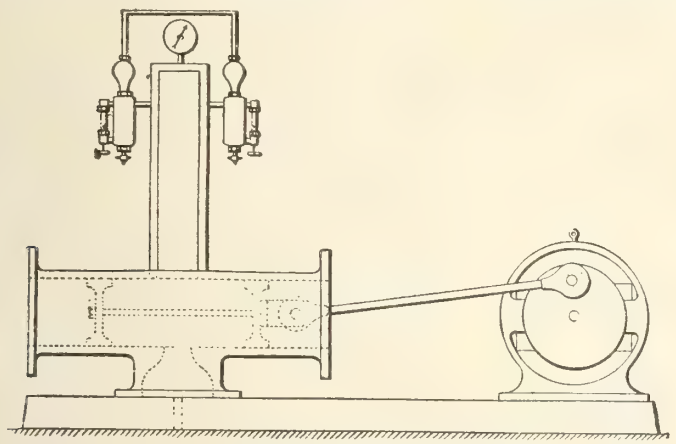


FIG. 1. DIAGRAM ILLUSTRATING PRINCIPLE OF CYLINDER FRICTION APPARATUS.

the two pistons by means of a crank disc and connecting-rod, and the net input of the motor is a direct measure of the friction of the two pistons and piston rings.

Full Size Apparatus

Actual dimensions of the apparatus are: Cylinder, 8-in. bore x 36-in. long, with a 3-in. drain from the middle of the bottom; connecting-rod 33 in. long, which with a stroke of 8 in. makes the maximum angularity of the connecting-rod less than 7 deg.

Ball bearings at each end of the rod make the connecting-rod friction negligible compared with the cylinder friction.

Two 1-pint. Detroit sight-feed lubricators supply oil in the usual manner to the steam pipes.

The piston-rings at present in use are of the constant-radial-thickness type. Each piston has five slots and one or all five slots may have rings placed in them. All the rings have a 3/8-in. face and each of the four sets has a different radial thickness, so that the intensity of pressure exerted by the piston-rings against the cylinder wall may have values from 2 to 9 lb. per sq. in. Suitably located thermometers indicate the temperature of the working surfaces. Arrangements were provided so that the outer sides of the pistons could also be subjected to any desired steam pressure. The difference in pressure on the two sides of the piston is an important element in the amount of oil feed necessary and the difference in temperature on either side of a piston, as in condensing engines, is an important element in determining the viscosity of the lubricant, and therefore the amount of friction encountered by the pistons and piston-rings.

Electric heating coils provide a means of testing with various degrees of superheat. A set of readings is plotted in Fig. 2.

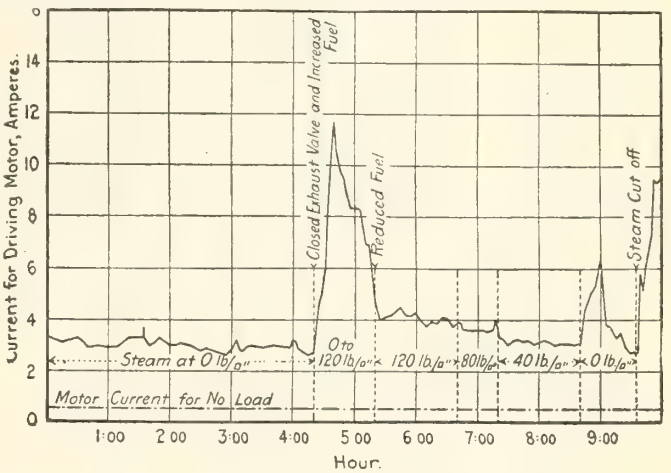


FIG. 2. READINGS AS TAKEN IN A TEST.

Peculiar Results

Variations observable in this test were largely due to the difficulty of controlling the oil feed. There was an excessive rise in friction amounting to 300-400 per cent. when the steam pressure was raised quickly from atmospheric pressure to 120 lb. per sq. in. This excessive friction does not occur when the steam pressure is increased gradually or when it is lowered; presumably it is caused by the sudden blowing of the oil out from the space between the piston-rings and the cylinder walls.

The effect of shutting off one of the two lubricators was to increase the friction within a few minutes, in spite of the fact that some oil was carried to the end at which the lubricator was shut off.

Shutting off all the lubricant caused an appreciable increase of friction within five minutes, when steam is present under pressure, but when steam is present at atmospheric pressure, it takes at least 30 minutes for the friction to change.

Conclusions

The author deals with various features, and amongst other results presents the following conclusions:

Different lubricants do not necessarily give the same friction coefficient, and their lubricating value can be determined by means of this apparatus.

Constancy of friction requires a liberal supply of lubricant, particularly when there is a difference of steam pressure on the two sides of the piston.

Cutting off or reducing the supply of lubricant brings about an increase of friction within 5 min.

Increasing the supply of lubricant may bring about a reduction of friction within 15 min., but at low pressures, or when starting a run with surfaces free from oil, it may take two hours to reach a consistently low value of friction.

An increase in the rate of feed of the lubricant makes a considerable reduction in the friction when the amount fed is small, but with a continued increase of feed of lubricant, the friction tends to approach a certain minimum value.

The friction coefficients obtained so far are all large, 3 to 4 per cent. or more, and very much larger than the values found in well-lubricated bearings.

The friction coefficients obtained and the amount of lubricant necessary are greatly modified by the presence of steam pressure on the two sides of the piston.

*From a paper read at the recent annual meeting of American Society for Testing Materials.

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SIGNALLING AT SEA IN WAR TIME

OUR illustrations relate to a series of flag signals which have been evolved for the purpose of signalling the presence, details, etc., of the enemy or a neutral fleet. The idea of the code is that at one hoist it is possible to indicate the nationality, number and type of vessels which have been sighted, as well as the direction in which they are steaming, and this is done in a simple manner, which

practically does not require the use of a code book for the reading.

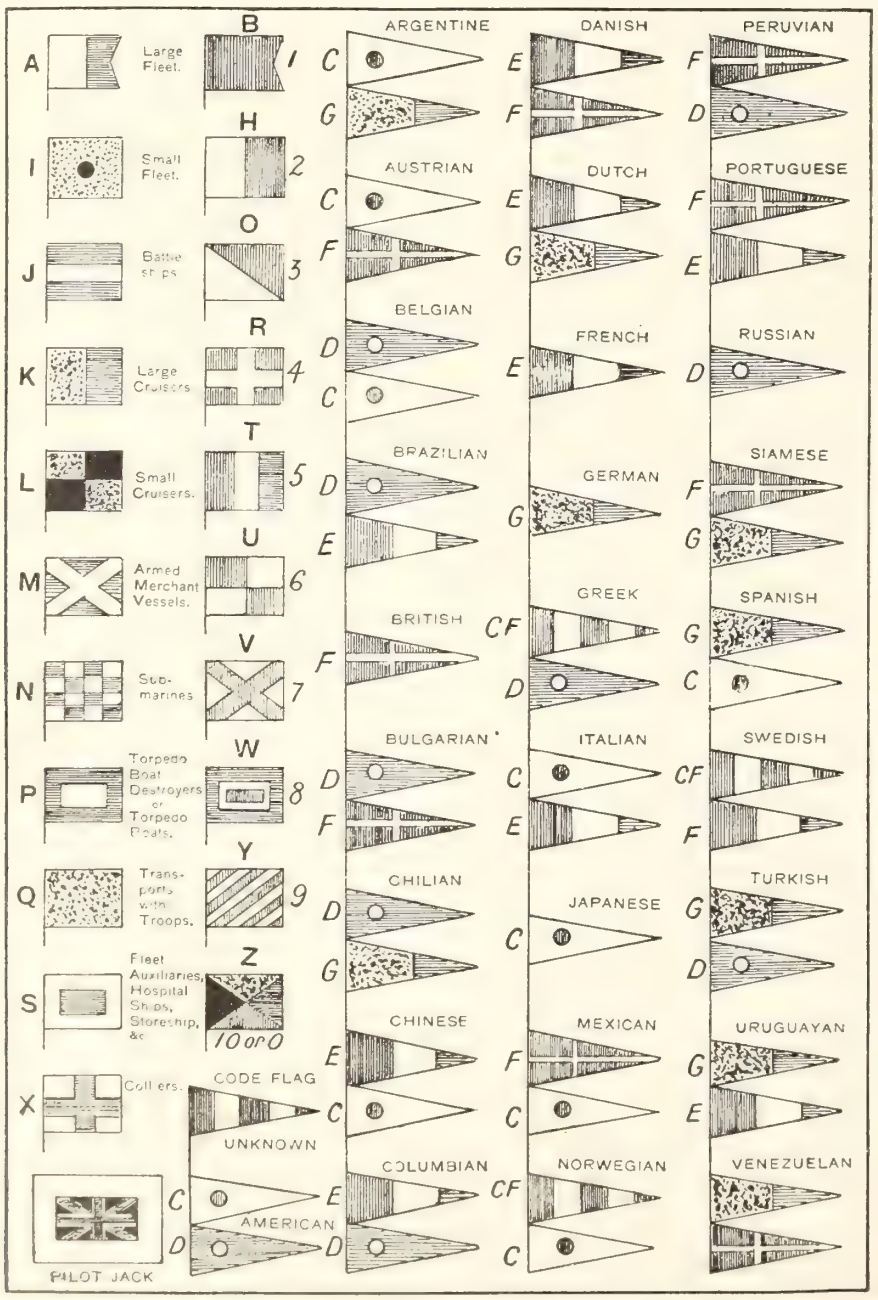
As every British merchant vessel carries a pilot Jack, this and the ordinary international code flags are all that are required for the hoist. The inclusion of the Pilot Jack in the hoist is an indication that the Pilot Jack Code is in operation, and, according to its position, so does it indicate in what direction the fleet which has been sighted is steering. For instance, if it is the first flag of the hoist, it indicates that the fleet is steering northward; the second of the hoist that it is steering to the south; and the third and fourth that it is to the east and west respectively.

The pennant flags, of which there are five in the set, are used exclusively in conjunction with the international signalling code flag and indicate the nationality of the vessel. As will be seen on reference to the table, the code flag used singly signifies an unknown vessel, while the single hoists of **c, d, e, f** and **g** pennants indicate Japanese, Russian, French, British and German vessels respectively; while if **c** and **e** are used in conjunction they indicate an Italian vessel, and a reversal of the flags bringing

KEY TO COLORS OF FLAGS.

them to **e** and **c**, indicates that the vessel is of Chinese nationality. In the event of two pennants being used to indicate the nationality of a vessel they are counted as one flag in the hoist, and therefore if the Pilot Jack follows two pennants that would be considered to be the second flag of the hoist, and would indicate that the vessels were steering southward.

In the signal code flags there are 10 square flags which contain red. These are **b, h, o, i, t, u, v, w, y** and **z**, and are used as numbers in that order, indicating the number of the vessels that have been sighted, the **z** being either used as 10 or 0, as occasion may require. Any two flags in conjunction, such as **r** and **w**, would, of course, represent 48. The other flags not containing red, of which there are 11, indicate the class of vessel about which information is being signalled. Further information with regard to the vessels is signalled on the international code in the ordinary manner.—Motor Ship.



SIGNALS USED FOR INDICATING THE PRESENCE, DETAILS, ETC., OF ENEMY OR NEUTRAL SHIPS.

PREVENTING CORROSION IN BOILERS

IT IS extremely doubtful whether the suspension of zinc slabs in a boiler will prevent scale, says the Electrical World. Scale is due to the presence in the feed water of substances like the sulphates and carbonates of lime and magnesia. When the water is heated, these substances are precipitated and are baked on the plates and tubes. The action of zinc in a boiler is galvanic and is intended primarily to prevent corrosion of the metal parts of the boiler. To prevent scale formation, it would have to change the nature of the sulphates and carbonates or else keep them from coming in contact with the boiler, neither of which it is able to do.

It is true that in the course of the galvanic action set up by the use of zinc, hydrogen is set free at the water surface of the plates and tubes, and the liberation of hydrogen in this way, if rapid enough, might prevent scale from adhering; but it is scarcely to be believed that the feeble galvanic action set up by the use of zinc slabs could produce hydrogen at a sufficient rate to keep all sediment and precipitates from collecting on the surfaces on the metal.

Canada Steamship Lines.—J. W. Norcross, vice-president and managing director Canada Steamship Lines, states that the record rates for transport of grain on the Great Lakes and Transatlantic will have a favorable influence on the result of the company's earnings this year. Arrangements have been made, Mr. Norcross said, for the chartering of seventeen of the company's steamers for the entire winter, but would not state what rates had been secured except to say that the charters were favorable.

Principles of Laying-Off Cylindrical Intersections--III.

By J. W. Ross

The more or less special nature of the work involved in the making of sheet metal piping has caused many manufacturers to avoid this class of work, with the result that when a job has to be handled, there is frequently considerable unnecessary loss incurred through errors in laying off material. The examples treated by the writer of this article should form a valuable reference to many manufacturers on ordinary as well as special occasions.

HEAVY PLATE TEE.

FIG. 1 showed in perspective a Tee which it is now proposed to develop in heavy plate. The front and side elevations are shown in Figs. 18 and 19 respectively. The measurements will be given in feet, the student reducing the dimensions to any desirable scale.

Construction.

Measure off C D Fig. 18 equal to 91 inches. Draw the lines A C and B D at right angles to C D, and equal in length to the outside dia. of the pipe which is 37 inches. Draw the line A B parallel and equal in length to C D. C A B D shows the side elevation of the horizontal cylinder.

Bisect A B at L, and raise the perpendicular J L 10. Measure off L 10^1 equal to 22 inches. Through and with 10^1 as centre, draw the line 7^1, 10^1, 1^1, at right angles to the line L 10^1, and equal in length to the neutral diameter of the pipe which is 36½ inches. Project the points 7^1 and 1^1 down at right angles to A B, locating the points 7^2 and 1^2 respectively. Connect these points which will show the neutral outline of the vertical pipe. Build around the neutral lines 7^1, 7^2, 1^1, 1^2, the cross section of the plate thickness. With O as centre describe the neutral plan view of the vertical cylinder. Divide this circle into a suitable number of equal spaces. This number to be at least divisible by four as was previously explained to show lines on each quarter of the circle. The greater the number of spaces the more accurate the developments. To save confusion of the lines in such a small drawing the number 12 has been chosen. Project all these points, parallel to 10, J, and down through A B, indefinitely. Now construct the end elevation view. Draw the centre line 7, E, Fig. 19 parallel to the centre line 10, J, Fig. 18. Project the line A B, Fig. 18 over to its intersection of the centre line 7 E, Fig. 19, thus locating the point 7^2. Locate the point E by projecting the line C D Fig. 18 over to the centre line 7E, Fig. 19. With centre K and radius K E describe the circle representing the end view of the outside circumference of the horizontal cylinder A B D C. Project the line 7^1 10^1 1^1, Fig. 18 over to 4^1, 1^1, 10^1, Fig. 19. With centre O^1 and radius equal to half the neutral diameter of the vertical pipe draw the circle 1, 4, 7, 10. Divide into 12 equal parts. This plan is shown as a quarter turn to that of the plan view in Fig 18. Therefore number accordingly. From all these located points drop projectors—parallel to 7 E—to the intersection of the horizontal end view. Number all these intersections in relation to the plan view. With K as centre, draw in the neutral circle line and thickness of the plate for the horizontal cylinder. Also build up the plate thickness around the neutral lines 4^1 4^2 and 10^1, 10^2. Horizontally project the points 1^2, 2^2, 3^2, 4^2, etc., Fig. 19, to their intersections of the similarly numbered vertical projection lines in Fig. 18. In this manner locating the mitre points by the points 1^2, 2^2, 3^2, 4^2, 5^2, 6^2, etc., Fig. 18. Connect these points by an even curve thus defining the mitre line. With

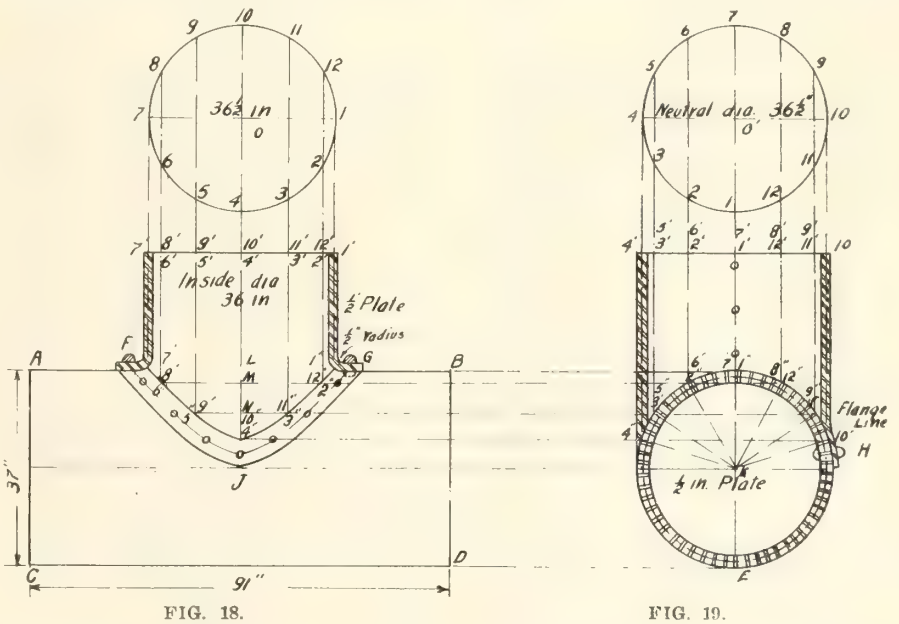


FIG. 18. FIG. 19.

¾ inch radius draw in the neutral line as at the points 1^2 and 7^2, Fig. 18. With ½ inch and 1 inch radii draw the cross sectional plate thickness. Draw in the laps. Locate the laps as F and G, Fig. 18. Similarly draw in the flange, rivet, and lap allowances as shown by H in Fig. 19. Now proceed to develop the vertical pipe.

The neutral diameter equals 36½ inches. The stretchout equals 36½ × 3.14 which is 114.61 inches or nearly 114⅝ inches. Measure off 1^1, 7^1, 1^1 Fig. 20 equal to 114⅝ inches. Divide into 12 equal spaces. Project these points downwards. Number with the object in view of having the vertical rivet seam on the lines 1^1, 1^2—1^1, 1^2. Now set the dividers to the distance 1^1, 1^2, and 7^1, 7^2, Fig. 19. Transfer this over to this numbered element lines in Fig. 20. Proceed in a similar manner by transferring the distances 2^1, 2^2, 3^1, 3^2, 4^1, 4^2, Fig. 19 to their respective locations in Fig. 20. In transfering these measurements ignore the flanges at F and G, Fig. 18, and H, Fig. 19. The reason for this is as follows:—4^1, 4^2, Fig. 19, is drawn without the flanges, the neutral line striking the circle as shown at 4^2. On the line 10^1 10^2 the flange is shown, and the neutral line is drawn in its correct relation to the plate thickness. To transfer 10^1 10^2 take the measurement as was done for 4^1 4^2. Draw an even curve through these located points on Fig. 20. This is shown drawn with short dash lines. This line would be the flange line in light plate. In heavy plate this line will change according to the thickness of the plate used. The plate thickness in the drawings Fig. 18 and 19 is somewhat exaggerated for explanatory purposes. Again to show it more clearly, the section of plate on the line 1^1, 2^2, Fig. 18, is enlarged in Fig. 21. In Fig. 21 the inside

*Note: The reference letters and numerals in the text, i.e., G^2, 7^2, etc., correspond with those of the illustrations indicated as G", 7", etc

radius of the bend is ½, therefore the neutral radius will be ¾ inches. R locates the centre for this radius and P and S the extremities of the quadrant. Bisect this quadrant at Q, thus locating the centre of the flange. Measure carefully along the neutral line the straight as well as the curve from 1^1 to Q. Take this distance and transfer it over to the line 1^1 1^2 Fig. 20, to locate the point Q, for the flange line of the templet. Again measure from Q to the centre of the rivet, and also from the rivet centre to the edge of the lap Fig. 21 transfer this also to the rivet line 1^1 1^2 Fig. 20 to locate the rivet line on the flange and the lap edge. These dimensions may be calculated. The neutral radius R, P, multiplied by 1.57 will give exactly the length of the neutral quadrant P Q S. R P equals ¾ inch, and ¾ × 1.57, equals slightly over 1⅛ inches, which is the length of the neutral quadrant P Q S. Now 1^1 P equals 22 inches minus the ½ inch for radius and the ½ inch for plate thickness, which equals 21 inches. P Q equals ½ of P Q S — 9-16 inches. Therefore 1^1 P, plus P Q, equals 21 9-16 inches. This dimension being equal to 1^1 Q in Fig. 20. Also Q S which equals 9-16, plus 1¼ inches to the rivet centre, plus 1¼ inches to the edge of the lap equals 3 1-16 inches total.

Q G, Fig. 21 therefore equals 3 1-16 inches. Measure off 7^1 Q G equal to 1^1 Q G Fig. 20. Refer back to Fig. 19. Measure along the neutral line the distance from 10^1 to the flange line Q and from Q to the rivet centre, and from the rivet centre to the lap edge, transfer these measurements to Fig. 20 on the lines 4^1 Q H and 10^1 Q H. With the five points Q located, draw in the flange in relation to the mitre line also draw in the rivet line and lap edge. Space off the rivet centres into a suitable number of equal spaces. One of the corners is scarfed, that is, thinned down, to permit of a close fitting joint at this point when the plate is rolled and fitted into position. As was stated before it is not the usual practice to put the holes in this templet. These holes being marked off when fitted on the rolled up horizontal cylinder.

The opening and the rivet holes will now be marked off in the cylinder as shown in Fig. 22. Calculate the stretchout of the horizontal cylinder of which the neutral diameter equals 36½. The stretchout equals 36½ × 3.14 which is nearly 114⅝ inches. Measure off D B D Fig. 22 equal to 114 ⅝ inches. Bisect to locate B, erect the perpendiculars B A, D C , and D C equal in length to that of D C Fig. 18. Draw the line C A C parallel to D B D . Draw radial lines from the points 1^2, 2^2, 3^2, 4^2, 12^2, etc., Fig. 19, to the centre K. Note where these radial lines intersect the neutral line of the cylinder of which K is centre. Transfer all these distances from these points measured along the neutral line as 1^2 to 2^2, 2^2 to 3^2, etc., Fig. 19, to the distances 1^2, 2^2, 2^2, 3^2, etc., on the line C A C, Fig. 22. Through these points Fig. 22 draw

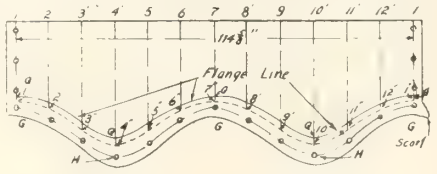


FIG. 20.

lines parallel to the centre line A B. Number these points and lines corresponding to the points from which they were transferred. Bisect C D at J and draw in the horizontal centre line J J. Locate L Fig. 22 at the intersection of J J with 1^2 7^2. Locate M at the intersection 2^2 6^2 and 12^2 8^2. Similarly locate N. Take the distance L to 1^2 on the mitre line Fig. 18, transfer this to L, 1^0 Fig. 22. Again

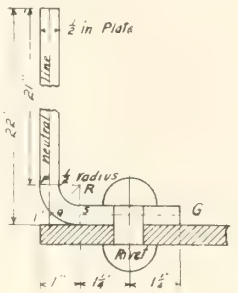


FIG. 21.

take the distance M 12^2 Fig. 18, and transfer over to M, 12^0, Fig. 22. Similarly transfer the remaining distances N, 11^2, N 3^2, L 7^2, etc., from Fig. 18 to their respective positions as N, 11^0, N 3^0, L 7^0, etc., Fig. 22. Connect all these points with a fair curve thus locating the outline of the opening. Take the distance 1^2 to the rivet centre at G Fig. 18 and measure this off to locate the rivet centre on the line 1^2 7^2 by measuring

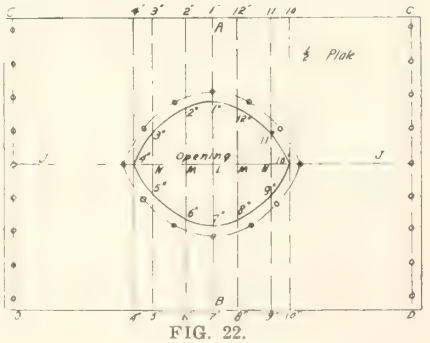


FIG. 22.

from the points 1^0 and 7^0. Similarly locate the other points for the rivet line. Draw in this line and space off the rivets equally. Space off the rivets equally on the seams C D, so that when the plate is rolled up all the holes will come fair. This completes the templet. The method in this problem of drawing the plate thickness is applicable to the preceding as well as the following problems when dealing with heavy plate.

Tee With Inclined Intersection

The perspective cut, Fig. 23, and the side and end elevation, Figs. 24 and 25, show a pipe interesting a larger pipe at an angle of 60 degrees.

Construction.

With centre O and radius equal to 1 inch, describe the circle P Q^1 1^2 Q^1 Fig. 24. This representing the end view of a horizontal cylinder of 2 inches in diameter. Draw the centre line P, O, 7 at right angles to the horizontal line Q^1 O Q^1. Continue the centre line Q^1 O Q^1 Fig. 24 over to Q Q, Fig. 25. Make this equal to 2¾ inches. At an angle of 60 degrees to Q R Q draw the line R 4. Project the points 1^2 and P, Fig. 24 respectively to the line C D and A B drawn parallel to Q R Q. Draw A Q C and B Q D at right angles to Q R Q. Measure L 4^1 equal to 1¼ inches. Draw 1^1 4^1 7^1 right angles to R 4^1. Make 4^1 the centre of the diameter 1^1 4^1 7^1 which is equal to 1¼. Parallel with R 4^1 draw the lines 7^1 7^2 and 1^1 1^2 to their intersection of the line C D. With centre X describe the circle 1, 4, 7, 10, with diameter equal to the neutral diameter of the inclined pipe. Divide this neutral circumference into 12 equal parts. Project these points—parallel with R 4—through the line C D. In a suitable position on the centre line P 7, draw the neutral circumference with the centre X, Fig. 24. Divide this into the same number of equal spaces as was done in Fig. 25. Parallel to the centre line project all these points down to the intersection of the cylinder Q^1 1^2 Q^1 P. Number accordingly where these points intersect the cylinder Fig. 24, project over by parallel lines to the intersection of similarly numbered inclined lines in Fig. 25, locating the points 2^2, 12^2, 3^2, 4^2, etc. Fig. 25. A fair curve drawn through these points locates the mitre line, and the flange line for light riveted pipe.

Development.

Measure off 1^1 7^1 1^1, Fig. 26 equal to the length of the circumference of the circle 1, 4, 7, 10 in either Figs. 24 or 25. Divide this line into 12 equal spaces. Draw vertical lines through these points at right angles to the line 1^1 7^1 1^1, Fig. 26. Number these points in consecutive order and in relation to the position of the longitudinal seam. Evidently 1^1 1^1, Fig. 25 will be the most suitable position for this seam as regards the driving of the rivets.

Take the distance 1^1 to 1^2, Fig. 25 and transfer this over to Fig. 26. Also take the distances 2^1 2^2, 3^1 3^2 4^1 4^2 etc. Fig. 25 and transfer these over to their cor-

rect position in Fig. 26. Through these located points draw the mitre line. Add on a suitable amount for lap and draw in the rivet lines.

In the preceding problems the measurements of the elements, for transferring to the templet, may be taken from either the side or end elevations. Take for example Figs. 2 and 3. The measurement of the element 1^1, 1^2 Fig. 2 is equal to the measurement 1^1 1^2 Fig. 3. And 7^1 7^2 6^1 6^2 5^1 5^2 etc, Fig. 2 are all equal respectively to 7^1 7^2 6^1 6^2 5^1 5^2 etc. Fig. 3. In Figs. 24 and 25 this is not the case. The reason why will be briefly explained without going too deeply into the principles of projection. In both views Figs. 2 and 3, the centre line of the vertical cylinder intersects at right angles to the centre line of the horizontal cylinder. All lines parallel to the centre line in one view to that of the other, will show the

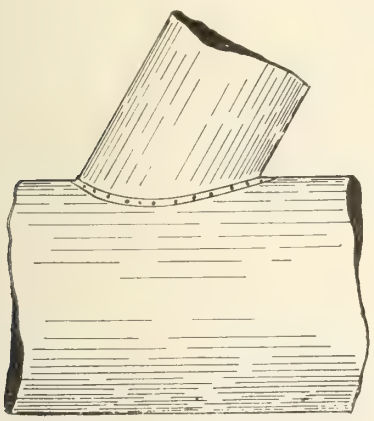


FIG. 23.

true lengths of the lines. This condition meets the case of Figs. 2 and 3 as all the vertical lines in Fig. 2 are shown vertical in Fig. 3. Therefore the true length of similarly numbered lines are equal in each view. The true length of a horizontal line is shown by a straight line in one view and by a point in another. So in the case just stated it does not matter which view these measurements are taken from, providing they meet the conditions which were stated. In Fig. 24 the elements—1^1 1^2 2^1 2^2, etc.—are parallel with the centre line 7 P, also the elements—1^1 1^2 2^1 2^2 etc.—Fig. 3 are parallel with the centre line 4 R. But all the elements of one view are not parallel with all the elements of the other view. Therefore, the true length is not shown in both views. In Fig. 24 the centre line is shown at right angles to the horizontal line. But in Fig. 25 the centre line is shown at an angle of 60 degrees to the horizontal line. Therefore the elements will be foreshortened in Fig. 24 and their true lengths shown in Fig. 25. As will be observed, the true length of elements were transferred from Fig. 25 to the templet in Fig. 26. By the way if the vertical centre line in Fig. 24 had also been inclined to the horizontal line, then the elements in both views would have been foreshortened.

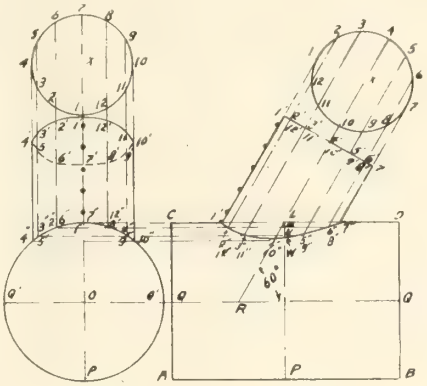


FIG. 24. FIG. 25.

The true length would then have to be found by construction. This construction method is termed triangulation, which will be explained in a forthcoming issue.

Development of the Intersected Pipe.

The diameter of the circumference P Q^1 1^2 Q^1 equals 2 inches. The stretchout will equal 2×3.14 which is 6.28 inches, or slightly over 6¼ inches. Measure off B D B Fig. 27 equal to this distance, Bisect at D and raise the perpendicular D C. Measure along the curve the distances 1^2 2^2, 2^2 3^2, 3^2 4^2 etc. Fig. 24, and transfer over to 1^2 2^2, 2^2 3^2, 3^2 4^2 etc. Fig. 27. From these points draw lines parallel to the centre line C D which is also denoted by 1^2 7^2. Bisect A B at P Fig. 27. Draw the centre line P P. Where P P intersects the elements, letter as shown in Fig. 27.

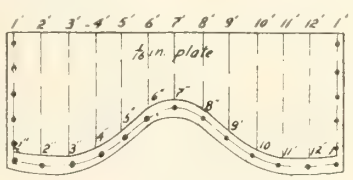


FIG. 26.

Bisect A B Fig. 25 at P. Erect the perpendicular P L. Locate the points M N W at the intersection of this line with the horizontal projection lines. Fig. 25. Set the dividers to the distance L 1^2 Fig. 25. Transfer to L 1^0 Fig. 27. Again

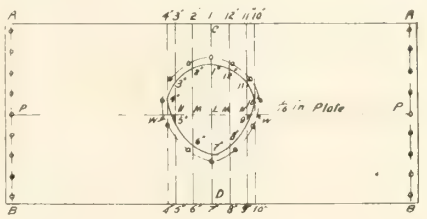


FIG. 27.

set the dividers to L 7^2 Fig. 25. Transfer this distance to L 7^0 Fig. 27. Similarly take the distances M 6^2, M 8^2, M 2^2, M 12^2, N 3^2, N 11^2, N 5^2 N 9^2, W 4^2 W 10^2, and transfer to their allocated lines in Fig. 27. Draw a fair curve through these points to define the opening of the cylinder.

Draw in the rivet line and space off the rivet centres at the proper distance from the edge of the opening. Divide A B into a suitable number of rivet centre spaces. Transfer these centres to its connecting seam A B. Add the laps to complete the templet.

TURBINE BLADE FASTENINGS

PERHAPS no field in the design of the steam turbine has been so much exploited as that of blade fastenings. Many ingenious methods have been devised from time to time. Some of the fastenings used to-day, states James A. Capstaff, in a paper read before the American Society of Naval Engineers, though highly suitable to meet the conditions existing at the time they were devised, must soon be consigned to the scrap heap or museum and give place to a fastening of unquestionably superior strength.

Too much stress cannot be laid upon the importance of strength. No blade fastening can be too strong. Most builders have at some time or other made up a test piece of their particular form of blade fastening, and had it pulled to destruction in a testing machine and demonstrated that it required a pull far exceeding the centrifugal force of which it would be subject when running to destroy it.

Although a carefully prepared test piece pulled in a testing machine affords excellent material for comparison with other methods, it is poor practice to use the test results as a criterion for running conditions. The unknown quantity enters too largely into this equation. The direct pulling strength of a blade fastening ought to be as great as possible, but not only that, the blade must be rigidly held in every direction with no possible clearance to allow of movement.

Steel Piston Rod Tests.—An American steel concern has announced the results of a series of tests on piston rods made of the steel it manufactures. The steel showed a tensile strength of 123,775 lbs. per square inch, an elastic limit of 82,600 lbs., with an elongation of 24 per cent. in 2 in., and a reduction of area of 53 per cent. In a revolution testing machine, 984,933 revolutions were required to break the test pieces at a stress of 30,000 lb. per square inch. This steel, which contains manganese, is produced in an electric furnace.

CONTEMPORARY WAR ARTICLES

Embracing Information and Data Drawn from a Variety of Sources Relative to and Arising from the Prosecution of this Many-Sided European War

EXPLOSIVES AND GUNS.

THE establishment of factories in Canada to manufacture high explosives from raw material produced in the country, marks another step forward in the ammunition industry of this country. Cordite, which forms the propelling agency in British shells, is of special interest to thousands of Canadians engaged in shell making. This material gets its name from the form in which it is produced. It is a mixture of gun-cotton, nitro-glycerine and a mineral jelly. The jelly is employed to convert the gun-cotton into a plastic substance which can be squeezed or rolled into any form desired, but which becomes hard and horn-like when dried. When the material is in a suitable state it is put into presses which squirt it through dies of the required size suitable for any bore of rifle or gun.

Rifle cordite is produced in the form of a thin cord, and is wound on a reel; the thicker forms of cordite for guns are cut into suitable lengths. The final stage of manufacture is drying, which takes as long as two months in some cases.

John B. C. Kershaw, writing in Cassiers' Engineering Monthly, makes the following interesting statements on the subject of modern explosives:

The required muzzle velocities and pressures for rifles and guns can be obtained, with variations that are exceedingly small. Thus for rifles, the velocity prescribed is 2,380 foot-seconds with a plus or minus of only 40 feet, and a pressure of 19.5 tons with a maximum of 20 tons per square inch; for larger guns it may be 1,500 foot-seconds, and the pressure must not exceed 19 tons per square inch.

Application of Explosives in Warfare.

Great developments have occurred in the application of explosives to warfare during the last thirty years, for the introduction of elongated projectiles, rifled guns, and high explosives has practically revolutionized land and naval warfare. It is difficult to realize now that at the battle of Waterloo the effective range of cannon was less than 2-3rds of a mile, and that as solid iron balls were employed, the destructive effect of artillery fire was confined to the individual or building hit. One round from a modern field-gun firing a 3-inch shell, in fact, will do more material damage, and kill or wound more men, than twelve hours' firing with the form of cannon used in 1815. It is also a fact that when the Dardanelles were last forced by a British fleet (in 1807) the Turkish guns were firing stone shot, and that in Nelson's day, naval actions were rarely commenced at a range of more than one thousand yards.

Explosives are divided into two distinct classes known as "high" explosives and "low" explosives, the chief function of the latter in warfare being as a propellant, while that of the former is to destroy life and fortifications, by the shattering effects of the explosion, which occurs when they are detonated. "Low" explosives, as a general rule, are employed in the form of cartridges in order to generate a steadily increasing force in the chamber of the rifle or gun, sufficient to project and carry the bullet or shell to its mark. "High" explosives are employed in a casing or canister of steel, and are detonated either by a time-fuse, or by percussion on striking the ground or the object aimed at.

The weight of the shell differs according to the size of the gun; that fired from the ordinary 3-inch field-gun varies in weight from 15 to 18½ pounds. An explosive shell differs from shrapnel in that it contains no bullets, and the damage done by it to buildings and human beings, when the charge is detonated, is due to the force of the explosion and to the flying fragments of the steel case when it bursts. The detonator employed for high explosives is fulminate of mercury mixed with potassium chlorate and enclosed in a copper container.

Types of Guns.

The quick-firing 3-inch field-gun is the most important weapon used by the opposing forces, and it is estimated that Germany at one period of the war had 5,000 guns of this type in the field. The German gun is a converted breech-loader, and fires a 15-pound shell with a muzzle velocity of 1,525 feet per second. It is light and of simple construction, but possesses several disadvantages which render it a second-class gun.

The French 75-millimeter and the English 3-inch field-guns are of more modern type than the German gun; the rate of firing can be maintained at 20 rounds per minute, if desired, for a short period. The English gun fires a shell weighing 18½ pounds, whereas the French gun fires a shell of 15 pounds with a muzzle velocity of 1,740 feet per second. The Allies' 3-inch field-guns are superior, therefore, in range, accuracy and firing speed to the German guns, and it was only by their greater number that the Germans gained many of their successes in the early stages of the war.

It is reported that the Germans have developed a new type of field-gun which is fed automatically with shells on the machine-gun principle, and that this gun can fire double or treble the number of shells per minute that was possible with the older pattern. This new weapon, it is stated, will be used against the Allies on the Western battle front, and time will show how far the claims for the new gun are substantiated.

The Howitzer.

A howitzer, it may be explained, is the short, heavy type of gun used for throwing shells at a high angle in order that they may fall vertically into the enemies' lines or entrenchments with a high striking velocity. Both the Allies and the Germans have been making great use of this type of gun in their attacks in Flanders and Northern France. The British field howitzer fires a 4.5-inch 35-pound shell, and has a range of 3,400 yards. The German weapon of this class is 4 inches in diameter and fires a shell weighing 31 pounds with a muzzle velocity of 985 feet per second. The projectile fired by this latter howitzer is shrapnel charged with bullets embedded in tri-nitro-toluol, and this is the shell which has accounted for many casualties in the British and French lines.

The British army in addition to the light field-howitzer, possesses a heavier gun, throwing a 60-pound shell with a range of 9,500 yards; while opposed to this the Germans have a 6-inch howitzer throwing a 90-pound shell, and capable of firing at an elevation of 65 degrees. The range to which a shell carries is, of course, diminished as the angle of fire is increased above 45 degrees, and the object of firing at such an acute angle as 65 degrees is to obtain a steep angle of descent, and to ensure penetration of any overhead cover by the shell when it strikes the ground.

Although it is not generally recognized, it is a fact that the application of explosives to warfare in the past has tended to keep the opposing forces far apart, and to diminish the amount of hand-to-hand fighting. This tendency has resulted in diminished casualty lists in proportion to the numbers engaged in

conflict, for it is only when engaged at close quarters in hand-to-hand fighting that the proportion of killed and wounded in armies can rise to fifty or more per cent.

This stage of warfare appears, however, to be passing away, and with the development of trench warfare and the use of poisonous gases, in addition to hand grenades and bombs filled with high explosives, we are once more confronted with conditions of combat which resemble those of earlier time. How far this development will proceed it is impossible to say. The powers of destruction that have been placed by the advances of science in man's hands are terribly effective, and it is quite possible that the limit has not even yet been reached.

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THE SPIRIT OF OUR SAILORS

THE unfailing spirit of the officers and men of the British Navy, says the Liverpool Journal of Commerce, has been brought out by many incidents of a heroic nature, but on the other hand many of these have passed unrecorded. In spite of the great difficulties under which naval warfare is now carried on, the men of the Royal Navy have never been found wanting.

Some few weeks ago, after a visit to the fleet, his Majesty the King sent a message of confidence to Admiral Jellicoe, his officers and men, which voiced the feeling of every member of the community, and only two weeks ago the Prime Minister and the Chancellor of the Exchequer paid a similar visit. The Prime Minister, in an address to a number of the officers and men, spoke some words of congratulation and confidence. That this confidence is not misplaced is shown repeatedly by incidents which, although minor in themselves, indicate that the supremacy of the sea, which the British Navy established practically at the outbreak of hostilities, is only maintained by constant watching and waiting, a state of affairs which must be very trying even to the most ardent spirits.

Germans Alert for Opportunity

The enemy fleets are all massed together in harbors which provide them with comparative safety; none the less, they are always on the lookout for possible openings, and the attack by the German auxiliary cruiser Meteor on the Isle of Man steamer Ramsey, shows that their picket boats are constantly testing the vigilance of the patrols in the North Sea. The fate of this vessel tells us that these experiments cannot be carried out with impunity, and a similar demonstration was given when two German destroyers were sunk after an attack on the trawler Columbian.

Our Submarine Exploits

Of the exploits of British submarines, the conditions under which the crews of these vessels operate are extremely arduous. Captain Perseus, a German naval expert, has admitted as much in a striking article contributed to the "Berliner Tageblatt." He says that almost fabulous skill is required to avoid all the pitfalls and get away from torpedo destroyers, and nevertheless make a successful attack, and that service aboard submarines demands the tension of all the mental and physical forces, apart from the quantity and quality of our (the German's) first-class material.

When viewed in this light, the exploits of our submarine crews in the Sea of Marmora read like the feats of supermen. The devotion to duty of the members of the engineering branch has often been praised in official despatches, and the conditions under which the work of the engineer is carried out in the bowels of the ship, with no knowledge as to how suddenly the end will come, render theirs no easy task. The story of the captain of the destroyer ———, issuing orders from the bridge after one leg had been shot away, will certainly go down to posterity, and the tenacity with which the officers and crews of the Monmouth and Good Hope stuck to their posts when the odds were hopelessly against them, makes sad, but nevertheless magnificent, reading.

The action taken by the captain of the Gloucester, when faced by the German cruisers Goeben and Breslau, immediately on their escape from the Straits of Messina, was all that could be desired. He maintained a bold front to the enemy and deluded them into believing that he had powerful assistance close at hand, while the reverse was the case. The destruction of the E15, grounded on Kephez Point, by a couple of picket boats exposed to the direct fire of the Turkish forts, forms another thrilling chapter in the records of great achievements.

Magnificent Opportunities Available

Small craft have been given many opportunities of distinguishing themselves under the circumstances appertaining to this naval war, and all their records are good. The thrilling report from Admiral de Robeck of the landing operations at the Dardanelles is studded with accounts of brave deeds which beggar all praise, and has been read with gratitude and satisfaction throughout the civilized world. The torpedo has played a prominent part throughout, perhaps because the conditions have been favorable to its operation, but on every occasion when an opportunity has been given for the use of guns, the gunners have taken full advantage of it.

While it is possible to recall such achievements, there can be no doubt as to the ultimate result; and when the opportunity comes for the Grand Fleet to show its calibre, we can rest assured that it will not be found wanting. In the meantime its officers and men are in reality dominating the naval situation, and all will remember "They also serve who only stand and wait."

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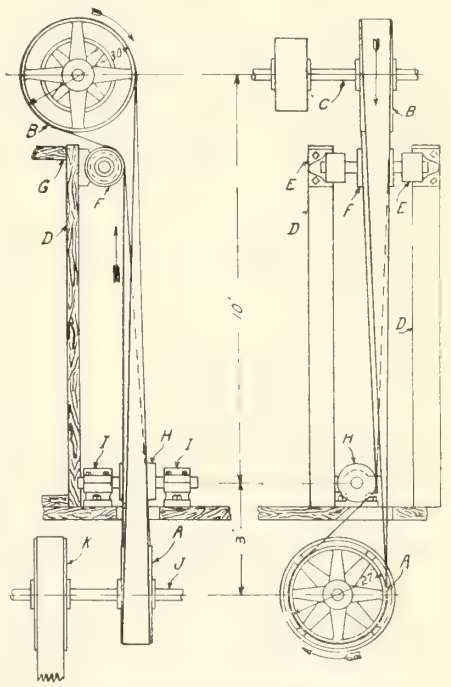
QUARTER TURN BELT DRIVE

THE accompanying sketch shows a quarter turn drive installed in the John McDougall Caledonian Iron Works, Montreal, to drive a large planer. While the arrangement may not be original, it may still be of some interest to our readers. The position of the planer was



LAYOUT OF QUARTER-TURN BELT DRIVE.

such that the counter shaft J would come at right angle to the line shaft.

The cut illustrates the method adopted to obtain the desired drive. The counter shaft for the planer is placed so that the lead of the pulley A comes directly below the face of the pulley B, which is on the line shaft C, the latter being located on the gallery above the main floor. The two planks D were erected to support the brackets E which carried the counter shaft on which the idler pulley F is secured. The planks D are kept in position by the brace G. The idler H is secured to the shaft that revolves in the brackets I; these being fastened to the floor as shown. The drive is through an 8-inch double belt, and has given satisfactory service over a considerable period.

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CANADIAN SHIPBUILDING LACKS ENCOURAGEMENT

ALL indications point meantime to a return of better trade conditions, and a distinctly optimistic tone is pervading business circles everywhere throughout the Dominion. The record harvest means in the first place real prosperity in the West, and, as this cannot be circumscribed, we in the East must of necessity become participants.

War orders are keeping most of our factories fully employed, the adverse trade balance has been eliminated and railroad and steamship earnings are now showing substantial increases. The steel trade is generally considered to be the barometer of industrial conditions, and in its present state of great activity gives reasonable grounds for hoping that the improvement in business now taking place is something more than temporary. The influx of large sums of money resulting from war orders cannot help but stimulate manufacturing, and with the improvement in Canadian fiscal conditions will lead to a marked industrial development in the country.

Developments in the shell industry are pending and arrangements are being made for the manufacture of shells up to 12 in. calibre. The duties and responsibilities of the Shell Committee have increased to such an extent that a reconstitution of its personnel is now in process to meet the demands of the situation. It is understood that the British Government have reserved large orders for shells for Canada, at a fair price, providing quick delivery can be made. A central ordnance factory for making big guns is also under consideration.

Little appreciation of the shipbuilding industry and the shipping situation is, however, being shown. The facts that merchant shipbuilding in Great Britain has almost ceased, that quite a large number and variety of sea-going craft have been destroyed, that many of our palatial passenger vessels, by the time their war transport service is over will have either been promoted to the "shipbreaker" sphere, or will require to be practically rebuilt, do not seem to put in action or initiate shipbuilding enterprise on the part of those already interested in Canadian business undertakings.

Shipbuilding is booming as never before in the United States and in neutral European countries, and should be in a similar condition here in Canada. Many of our lake vessels have been transferred to the ocean and ocean coasting trade, and from a business point of view are likely to remain in these services during the war and for many years thereafter. In addition, therefore, to seeing to the meantime supplementing of our lake and ocean coasting services, although in times past British shipbuilders have designed and supplied vessels for our Great Lakes, of special construction, so as to negotiate the canals leading thereto, may we not in turn build even in our inland shipyards similar craft for sea service?

We had expected long ere this to have seen definite steps taken to embrace the opportunity to put shipbuilding on a sound basis on our ocean as well as on our lake shores, but our principal shipowners and other vessel-owning corporations are either otherwise so engrossed or so lacking in enterprise as to be unaware of the opportunities which the war has put within their grasp. The cost of ships as a result of the war is likely to approach more uniformity, wherever built.

Marine News From Every Source

Bathurst, N.B.—It is announced that arrangements are being made for the completion of the harbor development work here.

Port Arthur, Ont.—The tug Seagull, owned by Captain Gehl, struck a rock east of Port Arthur on October 20, and sank. Her crew escaped in boats.

Kingston, Ont.—The steamer Byron Whittaker, with grain for Montreal, broke her rudder, lost her wheel and went aground near Cardinal, Ont., on October 18.

Sault Ste. Marie, Mich.—The Davis lock, which was put out of commision early on October 19, by the springing of the lower gate, was put into operation again the following night.

Cobourg, Ont.—The dredge Togo and the tugs R. G. Weddell and Minitiaga have arrived here. The former will be engaged for the next few weeks dredging out the entrance to the harbor.

The France & Canada Steamship Co. has been incorporated at Ottawa, with a capital of $1,000,000, to operate a line of steamers between Canada and France. The head office will be in Montreal, Que.

No Longer a Transport.—The C. P. R. liner Empress of Japan has been released from transport service by the British Admiralty, and is being refitted to again take up her station on the Pacific.

Port Arthur, Ont.—During the week ending October 16, nearly 12,000,000 bushels of grain were shipped from this port. Fort William receipts from the West for the same period were 10,000,000 bushels.

Sarnia, Ont.—Thirty steamers with cargoes of freight for the lower lakes were held up for sixteen hours Friday night and Saturday, October 8 and 9, when the freighter William Palmer went on the channel bank near Grosse Point, Lake St. Clair.

Quebec, Que.—As we go to press it is feared that the steamer Lady of Gaspe, which went ashore on Wednesday, October 13, close to the work piers of the Quebec Bridge, will have to be abandoned, attempts to float her having proved so far unavailing.

Record Grain Cargo.—The steamer W. Grant Morden on a recent trip from Port Arthur to Port Colborne carried a total of 476,315 bushels of wheat. The vessel is owned by the Canada Steamship Lines, and has a possible grain capacity of 480,000 bushels.

Ottawa, Ont.—The Government steamer Montmagny, which was rammed and sunk by the collier Lingan in the St. Lawrence over a year ago, is to be raised. The steamer now lies in ten fathoms of water off Grosse Isle. The contract for raising her has been awarded to the Levis Wrecking Company at $27,000.

Steamer "Otter" Abandoned.—The Canadian steamer Otter, which left Victoria, B.C., on Saturday, October 9, to assist in salvage operations on the wrecked Alaska liner Mariposa, went aground on St. James' Island, B.C., and has been abandoned as a total loss. The Otter was a wooden vessel of 336 gross tons.

Fire Aboard S. S. "Monteagle."—Fire broke out early on the morning of October 11 aboard the C.P.R. liner "Monteagle," and about 1,500 tons of cargo were damaged as a result. The Monteagle is a steel twin-screw steamer of 6,163 tons. She was built at Newcastle-on-Tyne in 1899, and is one of the C.P.R. Pacific fleet.

Sarnia, Ont.—The tug James Reid, of the Reid Wrecking Co., has returned to this port after completing wrecking operations on the tow barge Commodore, which became water-logged while coming down Lake Huron and sank in Thunder Bay River at Alpena. The boat was lightered of her cargo of pine and pumped out.

Hope Abandoned.—The Dominion Coal Co. has abandoned hope for the safety of its colliers, Kron Prinz Olav and Easington, which left Sydney, N.S., on September 25, the former for Montreal and the latter for St. John, N.B. The two ships ran into a hurricane on September 26. The Kron Prinz Olav had a crew of twenty-three men and the Easington carried twenty men.

Canada Steamship Lines.—Five vessels of the Canada Steamships Lines fleet, now engaged in lake trade, are being reconstructed, and will be placed at the disposal of Canadian grain exporters for ocean service. This is the first step taken by the commission at Ottawa, of which Hon. Robert Rogers is president, to relieve the scarcity of tonnage, which is hampering Canadian export trade.

Steamer McKee Libelled.—Acting for the Government, Phil. Birkenhauer, Deputy United States Marshal, seized the steamer J. A. McKee in Toledo harbor, the vessel having been libelled for $30,000 damages by Roderick Murray, Toledo. Sault Ste. Marie, Canada, is the home port of the boat. Murray claims that while unloading steel rails from the J. A. McKee last June he was seriously injured and rendered incapable of manual labor for life.

Pacific Coast Salvage Contract.—The Department of Marine and Fisheries has renewed a ten-year contract with the British Columbia Salvage Company for the maintenance of a wrecking plant in Pacific Coast waters. The existence of an arrangement of this kind has proven beneficial in the past, both from the results in actual salvage and from the encouragement which it affords to shipping companies to make Canadian ports on the Pacific. The contract is worth $10,000 a year.

Panama Canal Slide.—A careful survey of the slide area in the Galliard cut reveals the fact that there probably are 10,000 cubic yards of earth in motion which must be taken out by dredging operations before a permanent channel through the cut is possible. This conclusion has, we understand, been reached by the Panama Canal engineers, who concede that there is now little hope of reopening the waterway, even for the temporary use of shipping, much before the first of the new year.

Little Current, Ont.—The steel steamer Western Star, owned by H. K. Oakes, Cleveland, Ohio, in charge of Capt. Sloan, struck Robertson Rock north of Clapperton Island on the morning of September 25, and sank in two hours. The crew and passengers rowed to Clapperton Island, a distance of half a mile, in the lifeboats, and were then towed by a gasoline boat thirty miles to Little Cur-

rel.'. The steamer was carrying seven thousand tons of coal from Toledo to Little Current for the Empire Coal Co. of Montreal.

Ottawa, Ont.—Tenders will be received up to Tuesday, November the 23rd, for the undermentioned items for delivery to H.M.C. Dockyards at Halifax, N.S., and Esquimalt, B.C.: Steel and iron bolts, nuts and rivets, electric cable and wire, mineral grease. castile soap, hard soap, turpentine, chemicals, cleansing powder, bunting. Forms of tender and all information may be obtained by application to the Naval Store Officer at H.M.C. Dockyards at Halifax, N.S., or Esquimalt, B.C., or to G. J. Desbarats, Deputy Minister of the Naval Service, Ottawa.

Str. Donnacona Lost—A despatch from Plymouth to Lloyds reports that the British steamer Donnacona, bound from England to Nova Scotia, was abandoned at sea on Oct. 10, as a result of damage done by storms. The crew was picked up by the British ship Ariel. The Donnacona was of 1,906 tons, 245 feet long, and was built in Great Britain in 1900. She was formerly in the Great Lakes service between Montreal and Port Arthur, being owned at Hamilton before passing over to the Canada Steamship Lines. The steamer was under Government charter.

Canadian Coasting Laws.—The Lake Carriers' Association, of Cleveland, Ohio, has been officially notified that the Canadian coasting laws have been suspended and American ships will be permitted to trade between Canadian lake ports during the remainder of the season. During the navigation season of 1914 there were 105 vessels of Canadian registry employed in the grain carrying trade on the Great Lakes, their totai tonnage being 350,000. Owing to the transfer of many of these ships to the ocean trade, there are available this season only 56 Canadian ships, with combined tonnage of 109,000.

Candian Coasting Laws Suspension.—There is absolutely no necessity for suspension of the Canadian coasting laws, say boatmen at the head of the lakes. Canada Steamship Lines, they declare, will be quite capable of transporting the grain from Fort William to lower lake points as fast as the receiving elevators at such ports can take it. They claim that suspension of the coasting law would be unfair as, for the past two years, rates have been low and cargoes so scarce that operations were carried on in many instances, at a loss. With high rates and a big crop, prospects are bright for this season. The suspension of the coasting laws would allow American steamers to carry grain from and to Canadian ports, and consequently rates would drop.

Soo Canal Traffic—Eastbound traffic through the St. Mary's Falls Canals, Sault Ste. Marie, Ont., shows a large increase over September of last year, according to the monthly statistical report compiled by the engineer's office. Last year, 6,368,408 tons were locked through eastbound, while during September, 1915, 907,771 tons passed the Soo. The increase is shown in the entire list of commodities except flour, iron ore leading, of which 7,796,965 tons were carried through, or 2,509,808 tons more than September, 1914. Copper also shows a heavy increase, being 9,160 tons over last year. The amount of grain and wheat locked for lower lakes elevators was 31,927,870 bushels, against 27,579,-621 for September, 1914, or an increase of 4,668.249. The passenger list eastbound during September this year was nil. Westbound traffic shows a decrease. The total freight, however, showed a net increase of 2,561,735 tons, 445 more passages being registered for the month over last year.

WESTERN DRY DOCK & SHIP-BUILDING CO.

SINCE the opening of navigation the Western Dry Dock and Shipbuilding Co., ort ArthPur, Ont., have built one fish tug, the Rossport, with dimensions of 58 ft. x 12 ft. x 6 ft. 6 in.

Twelve vessels have been dry docked and the Meaford is in dock now with a two weeks' job on hand, which will finish the month on repairs at this port.

With the end of October, the dry dock at Port Arthur will have had 28,000 gross tons of vessels docked, a number of the jobs being fairly large. The Turret Chief cost $52,000 for overhaul, to which must be added another $20,000 between Port Huron and Lorain where new boilers were installed.

The re-classing of the Paliki by Lloyd's gave the dry dock a lot of work, costing the owners and underwriters between them some $20,000.

The Meaford has 35 damaged plates and the interior of the bottom is badly crushed. Good work will be done if she is gotten out in two weeks.

With the manufacture of shrapnel and high-explosive shells, and, incidentally, bull tractors, the whole plant has been fairy busy up to date. The vessels were docked as follows:

J. Frater Taylor, April 28, 14 plates damaged.

Neepawah, May 22, loose rivets and stern bearing.

Turret Chief, May 27, 126 plates and considerable interior damage.

Paliki, July 4, re-instated in Lloyd's, +100A1.

Glenfinnan, July 16, 25 plates.

Glenlivet, Aug. 21, 15 plates.

Barge Scotia (wood), Aug. 21, bottom caulked.

Glenlyon, Sept. 1, loose rivets and caulking.

Turret Cape, Sept. 2, 21 plates.

Collingwood, Sept. 9, 10 plates.

H. E. Ames, Sept. 9, 22 plates.

Corunna, Oct. 4, 7 plates.

Meaford, Oct. 21, 35 plates.

MONTREAL'S POSITION AS A GRAIN PORT

THE steady progress of Montreal towards supremacy in grain exporting on the Atlantic seaboard was referred to by a speaker at the annual convention of the New York State Waterway's Association, held recently in Syracuse, N.Y. It was Frank S. Ellsworth, secretary of the association, who brought up the matter in the course of an address on "The Commerce of New York." After referring to the commercial importance of New York and indicating the necessity for the development of the commercial highways to the port, he touched on the rivalry of American and Canadian coast cities.

He contrasted the steady increase in the volume of grain tonnage handled through the port of Montreal since 1901, amounting to 68,897,394 bushels in 1914 over 1901, which was an increase of about 2,000,000 bushels in excess of the decrease shown in the grain tonnage of United States ports from 1907 to 1914, although the port of New York showed an increase of 22,481,119 bushels for the fourteen-year period. These conditions, reflecting a decrease in the volume of grain tonnage handled at such ports as Boston, Baltimore and Philadelphia, aggregating over 75,000,000 bushels from 1901 to 1914, Mr. Ellsworth said, should direct attention to the importance of emulating Canada's avowed policy to "conduct Canadian commerce through Canadian channels."

There is a quiet struggle in progress, he continued, between Canada's principal ports and American Atlantic ports for commercial supremacy. This fight, Mr. Ellsworth declared, has been going on apparently without notice for a number of years, and one of the principal "preliminary engagements," was that successfully conducted by the New York Produce Exchange in 1910 and 1911 against the "practically prohibitive railroad rates of ex-lake export grain at and east of Buffalo." The contest, however, is no affair of a day, a month or a year, but is endless and calls for the most earnest thought, strategic ability and resourcefulness of American business men, he added.

ELEVATOR FOR TRAMP STEAMERS AT MONTREAL

ACCORDING to W. G. Ross, president of the Montreal Harbor Commission, that body is prepared to urge upon the Government the necessity of proceeding with the construction of an elevator east of the present hay sheds, and four berths for tramp vessels coming to the port for grain, at a total cost of two million dollars, as soon as conditions make it possible.

The Harbor Commissioners have on several occasions considered the question of constructing a special elevator in some such location as Windmill Point, Maisonneuve or east of the commissioners' hay sheds. In these locations space is of less value, and there would be for many years less congestion.

The map of the harbor, issued with the annual report for last year, shows a proposed location for an elevator just east of the hay sheds, or opposite Delorimer avenue, which it is expected will be required in the very near future. Wharves are fast being constructed in this neighborhood, and next year will see them completed. There will be ample room for railway tracks, excellent unloading facilities, and as the sheds will only be built on this bulkhead wharf at certain distances apart, the interveining berths will have conveyors which will give special facilities for tramp vessels not requiring sheds.

The whole matter has been thoroughly considered by the Commissioners and by their engineers, and full information is at hand. It is expected that as soon as conditions more favorable for capital expenditure are reached, the Commissioners will carry on the proposed program of keeping up as much as possible with the commerce of the country.

At present the Harbor Commissioners' two elevators connect by their conveyor system with fifteen berths and the Grand Trunk elevator with two berths. As soon as the proposed sheds on Victoria Pier are completed, three additional grain berths will be provided.

Lack of Tramp Tonnage

Up to the present, however, the requirements in Montreal Harbor, as shown by congestion and delays, have been the result of lack of tramp tonnage. In 1914, by far the heaviest and best grain year in Montreal harbor, grain had to be diverted to American routes on many occasions when the Harbor Commissioners' elevators were full to the last bin. The commission's elevators are found to be unusually desirable on account of their fireproof qualities, their excellent storage which keeps the grain in good condition, and the availability of turning over and airing on the belts when required; also in the excellent position for shipping to meet market conditions.

With regard to a special elevator for tramps, the commissioners are prepared to build it in location shown on plan in last official report as soon as conditions warrant. The shipping public must, however, understand what it costs to build and operate an elevator, and how much business is required annually to make it pay.

To build an elevator of a capacity of 1,500,000 bushels with conveyors to four berths, would cost approximately $1,000,000. To build four berths with the necessary land site, railway yards, etc., would cost another $1,000,000. Interest, upkeep, power, operation, etc., will therefore cost annually some $200,000. At the present tariff rates the commissioners would be out of pocket every year unless the receipts of this proposed elevator reached 20,000,000 bushels. Located away from the regular lines, such an elevator would be almost entirely dependent on an ample supply of tramp boats.

In view of the splendid prospects noted in the West by the commissioners in the trip from which they have just returned, it is their opinion that the requirement of this extra elevator will not be long delayed.

MONTREAL HARBOR CONSTRUCTION WORK

AN inspection tour on October 18, by the three commissioners, Major David Seath, secretary, F. W. Cowie, chief engineer, M. P. Fennell, jr., and J. Vaughan, superintendent of railway terminals, revealed the fact that by the middle of next summer the permanent construction work of Montreal Harbor will be finished for that section of the port which stretches from McGill street to the hay shed.

For some years the harbor work has been impeded to some extent by the very effort of the harbor authorities to bring the port up to an efficiency which would enable it to deal with the business which the west sends down to it. From next summer the problems of this part of the harbor will concern solely the administration of the facilities provided.

The commissioners on leaving their office proceeded to the place where the large addition to Elevator No. 1 is being constructed by the Fuller Construction Co. They expressed pleasure at the progress which had been made. The lower set of bins are now completed to the top, and the set on the shore side, which are about 19 feet higher, will be completed shortly. The whole thing will be covered in before the cold weather arrives, so that all through the winter work can go ahead with the installation of machinery and necessary interior work. The cupola will be on in a few weeks, and the commissioners were able to say after the inspection that the new building would be ready by the early summer of 1916.

Victoria Pier End

The commissioners also inspected the office building in its new position on the wharf, where it was moved to make room for the addition to Elevator No. 1. In the basement of this building the police department will be housed, as last year.

The last crib just put in place at the river end of Victoria pier has completed that pier, so far as its length is concerned. All that now remains to do is to build it up to the high level. Although this will not be accomplished this season, the work will be sufficiently advanced so that the winter ice will not damage it. Next year it will be finished in good time, and, when it is completed, Victoria pier will add about 2,500 lineal feet of harbor frontage to that available for ocean vessels, and 4,800 lineal feet along the inner side for lake and river vessels.

The commissioners and the departmental heads accompanying them afterwards proceeded by flat car along the higher level tracks of the harbor system down to the dry dock, to see what progress had been made with the filled-in land, and the extensions being made by the Canadian Vickers Co. The work done here has been little short of extraordinary, the activity being indicated by the fact that parts filled in only last summer are already built upon.

The party also traversed the high level tracks of the system, which have now been extended beyond Dominion Park, to connect ultimately with the Pointe aux Trembles wharf, built opposite the Canada Cement Co. premises. The flat car took the party almost down to Pointe aux Trembles, a sufficient indication of the progress of this extension of their railway system.

CANADA'S MERCHANT MARINE

ADDRESSING the Montreal Chambre de Commerce on his return from a visit to our Pacific Coast, Frank Panzé, in his capacity as president, said that the Canadian merchant shipping situation was one that required grave consideration, inasmuch as at our Canadian ports there was a shortage of boats. A merchant marine was the index of a country's prosperity, and he felt that all that could be done had not been done. He was convinced from a visit to Winnipeg that the great part of the Western grain would come to Montreal if Montreal had more vessels to take care of the crops.

In efforts toward improving the ports of Canada there was a great work ahead for the Chambre de Commerce, working hand in hand with the port authorities, in such matters especially as securing the bettering of railway facilities and the regulation of railway transportation in connection with the ports.

ASSOCIATION AND PERSONAL

A Monthly Record of Current Association News and of Individuals Who Have Been More or Less Prominent in Marine Circles

Captain John Brems, one of the best-known dredge men in the Province of Ontario, died at Brighton on October 5, aged 61 years.

Capt. Charles H. Jenkin, for many years in command of Grand Trunk car ferry boats, and well known in Great Lakes marine circles, died at his home in Detroit last week after a long illness.

William Walters, inspector of the new harbor improvements at Toronto, Ont., died at Lindsay, Ont., on Oct. 5. The deceased was born at Kingston, Ont., on Aug. 11, 1854.

Captain F. X. Laviolette, recently commander of the steamer Three Rivers, has been appointed to a like position on the Montreal Harbor Commissioner's tug, Sir Hugh Allan. Captain Laviolette has been with the Richelieu & Ontario and the Canada Steamship Lines for over 30 years.

J. Norwood Duffus has taken over the interest of the late Mr. Francklyn in the well known firm of S. Cunard & Co., Halifax, N.S. The business is one of, if not the oldest established in Halifax, probably in the Maritime Provinces, and represents the Cunard, Compagnie Generale and other steamship lines. They also are general agents for Lloyds.

MARINER'S LAST PORT

CAPTAIN JACKMAN, master mariner, who sailed the Great Lakes and the ocean during forty-five years, died on October 26, at the home of his son, Harry Jackman, 140 Bay street, Toronto.

Deceased was born 72 years ago in Sussex, England, and, upon coming to Toronto at the age of twelve years, commenced his marine life with his uncle on Lake Ontario. At twenty-five he went as mate under his uncle, the late Captain Frank Jackman, on a voyage in the Oakville-built brigantine Sea Gull from Toronto to South Africa. Leaving the wharf at the foot of Yonge street in June, 1865, the Sea Gull arrived back in the Toronto Harbor in July, 1866, after a voyage of thirteen months. Of the Sea Gull and the voyage, Volume 3 of Robertson's Landmarks of Toronto says:

"This voyage was never attempted before, or accomplished since by a lake vessel. The Sea Gull was built in Oakville in 1864, by John Simpson, who with his brother built a great many of the once famous Oakville schooners. The vessel was owned by John Murray of Oakville, and Frank Jackman, sen., of Toronto, and was registered in this port. These were her dimensions:

Length over all, 105 feet; evtreme beam, 42 feet; draught, when loaded, ten feet; when light, four feet six inches.

"Frank Jackman, senior, was captain; his nephew, James Jackman, mate. Captain May, a salt water sailor, acted as navigator. About $9,000 was paid for the trip, and after all bills were settled there was $2,000 profit. A sample of South African rum was brought back and kept on tap in the captain's cabin. Verily, a little of it went a long way—thousands of miles—and old mariners declare it was strong enough to knock a man down."

Some of the other vessels on which the late Captain Jackman sailed were the Wanderer, J. G. Worts, Annie Mulvey, Marquis and D. M. Foster. He was wrecked in the latter.

LICENSED PILOTS.

ST. LAWRENCE RIVER.

Captain Walter Collins, 43 Main Street, Kingston, Ont.; Captain M. McDonald, River Hotel, Kingston, Ont.; Captain Charles J. Martin, 13 Balaclava Street, Kingston, Ont.; Captain T. J. Murphy, 11 William Street, Kingston, Ont.

ST. LAWRENCE RIVER, BAY OF QUINTE, AND MURRAY CANAL.

Captain James Murray, 106 Clergy Street, Kingston, Ont.; Capt. James H. Martin, 259 Johnston Street, Kingston, Ont.; John Corkery, 17 Rideau Street, Kingston, Ont.; Captain Daniel H. Mills, 272 University Avenue, Kingston, Ont.

ASSOCIATIONS

DOMINION MARINE ASSOCIATION.

President—A. E. Mathews, Toronto. **Counsel**—F. King, Kingston, Ont.

GREAT LAKES AND ST. LAWRENCE RIVER RATE COMMITTEE.

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INTERNATIONAL WATER LINES PASSENGER ASSOCIATION.

President—O. H. Taylor, New York.
Secretary—M. R. Nelson, 1184 Broadway, New York.

THE SHIPPING FEDERATION OF CANADA

President—Andrew A. Allan, Montreal; **Manager and Secretary**—T. Robb, 218 Board of Trade, Montreal; **Treasurer**, J. R. Binning, Montreal.

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A. F. Hamelin, Montreal, Que., Grand Vice-President.
Neil J. Morrison, P. O. Box 238, St. John, N.B., Grand Secretary-Treasurer.
E. Read, Vancouver, B.C., Grand Conductor.
A. J. Ross, Halifax, N.S., Grand Doorkeeper.
James Gillie and A. E Kennedy, Kingston, Ont, Grand Auditors.

Northern Pacific Ports is the title of a book compiled and published by the Terminal Publishing Co., Inc., San Francisco, Cal. This is the second edition and the contents consist of useful marine, exporting and importing information for Alaska and the western coasts of Canada and the United States. The book contains a great deal of useful information for shipping concerns, traders, port authorities, etc. Brief mention of some of the subjects dealt with will give an idea of the scope of this publication. These are as follows:—Navigation laws of the United States. particulars of the various ports along the seaboard of the North Pacific including their harbor rules and regulations, list of transportation companies and their fleets, matters pertaining to Canadian and United States customs, currency tables, Rule of the Road at Sea, etc.

1915 Directory of Subordinate Councils, National Association of Marine Engineers.

Name.	No.	President.	Address.	Secretary.	Address.
Toronto,	1	Chas. M. Arnott,	94 Hanley Street	J. S. Adams,	631 Gladstone Ave.
St. John,	2	G. J. McVicar,	49 Winslow St. West	G. T. G. Blewett,	36 Murray St.
Collingwood,	3	Wm. Whipps,	Collingwood, Ont.	Robert McQuade,	Collingwood, Ont.
Kingston,	4	L. E. Spencer,	24 Clergy St.	James Gillie,	101 Clergy St.
Montreal,	5	Henry Lamereaux,	280 St. Andre St.	O. L. Marchand,	278 Clark St.
Victoria,	6	John E. Jeffcott,	Esquimault, B.C.	Peter Gordon,	808 Blanchard St.
Vancouver,	7	W. G. Wooster,	Room 10, Jones Bldg.	E. Read,	Room 10-12, Jones Bldg
Levis,	8	Michael Latulippe,	Lauzon, Levis, Que.	S. G. Guenard	Bienville, Levis, Que.
Sorel,	9	Nap. Blandon,	Sorel, Que.	Alf. Charbonneau.	Box 204, Sorel, Que.
Owen Sound,	10	John McLeod,	570 4th Ave.	J. Nicoll,	714 4th Ave. East
Windsor,	11	Alex. McDonald,	28 Crawford Ave.	Neil Maitland,	921 London St. W.
Midland,	12	Geo. E. Wilson,	P.O. Box 204	Roy N. Smith,	Box 178
Halifax,	13	Robt. Blair,	29 Preston St.	Chas. E. Pearce,	Portland St., Dartmouth, N.S.
Sault Ste. Marie,	14	Charles H. Innes,	27 Euclid Rd.	Geo. S. Biggar,	43 Grosvenor Ave.
Charlottetown,	15	Philip Bridges,	Stewart St.	Chas. Cumming,	27 Easton St.
Twin City,	16	H. W. Cross,	136 Ambrose St	E. L. Williams	142 Secord St., Port Arthur, Ont.

LAKE TONNAGE SHOWS INCREASE

COPPER and iron ore again show an increase over August of last year in the monthly statistical report just issued of traffic carried through the St. Mary's Canals at Saut Ste. Marie, Ont. The copper increase is 5,773 tons; iron ore, 1,971,762. A better showing is also made in general merchandise westbound, 58,909 more tons being locked through this year. The total freight tonnage was 10,540,781 tons. Last year it was 8,934,981. Vessel passages were 231 more than August, 1914. The number of passengers carried through on steamers was only 115 less than last year. Of the total amount of freight, 748,810 tons were carried through the Canadian locks, and 9,791,971 through the American side.

Vessel passages numbered 3,219, with registered tonnage of 8,293,477. There were 8,249,257 short tons of freight eastbound, and 2,291,544 short tons westbound, a total of 10,540,781 short tons of freight for the month.

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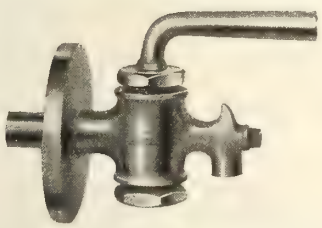
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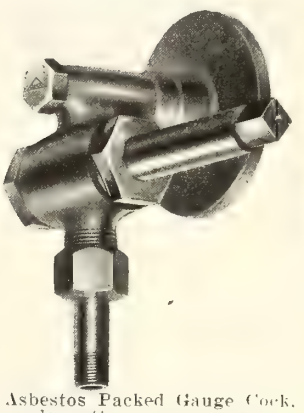
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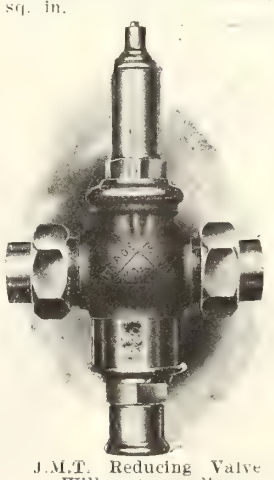
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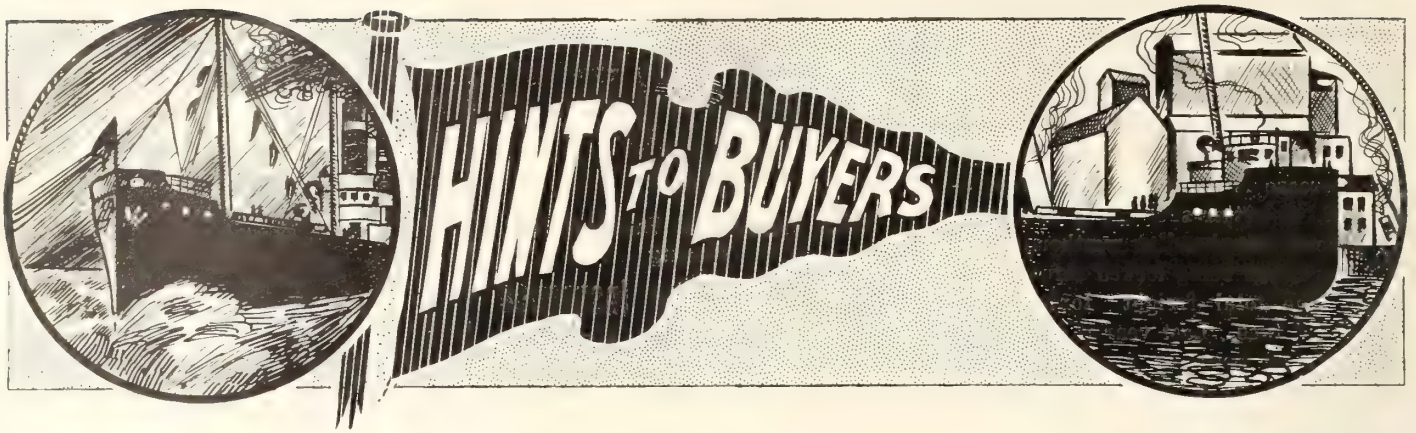

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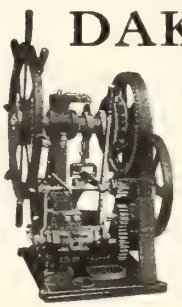

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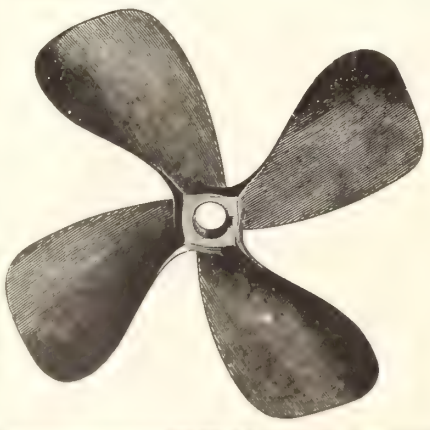

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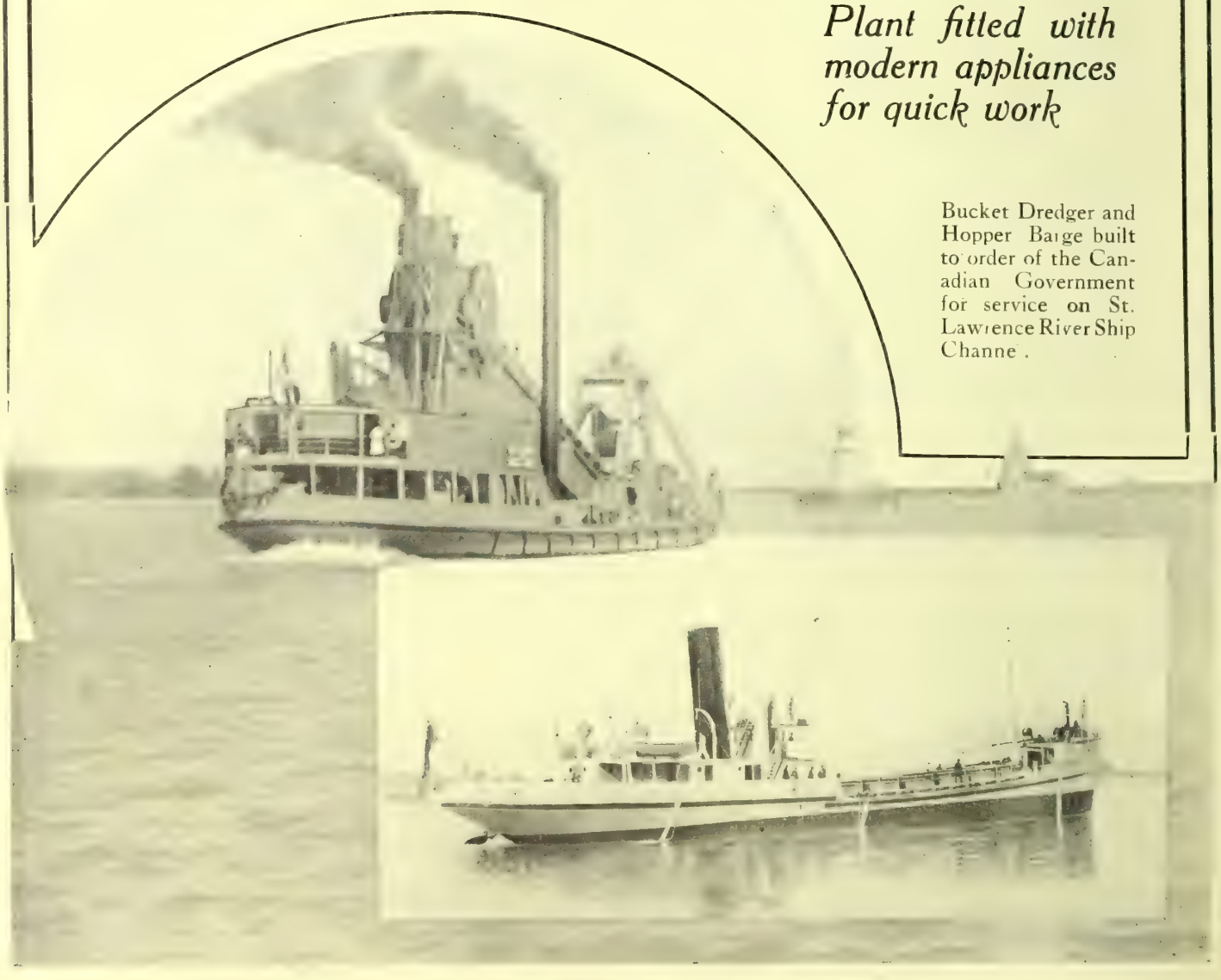

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Vol. V. Publication Office, Toronto—November, 1915 No. 11

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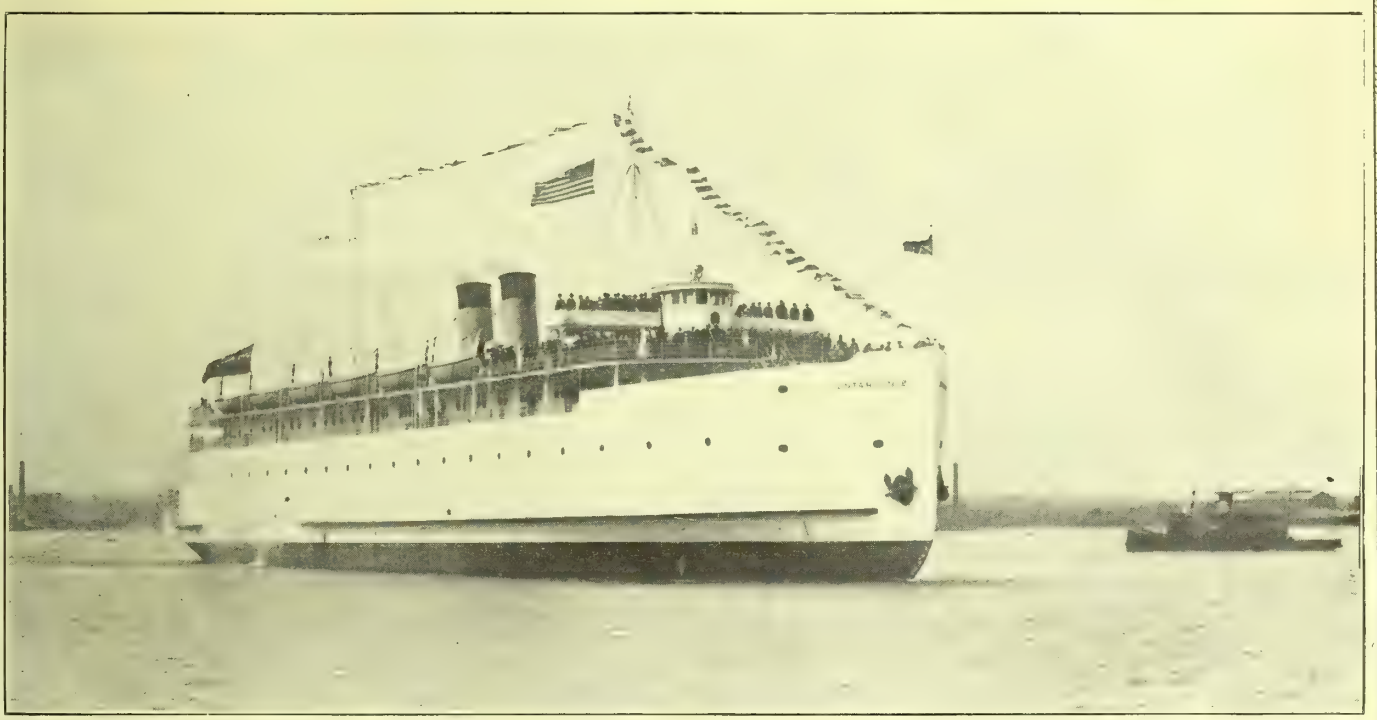

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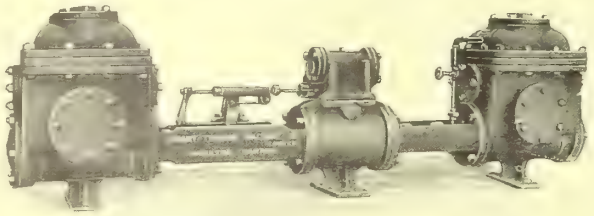

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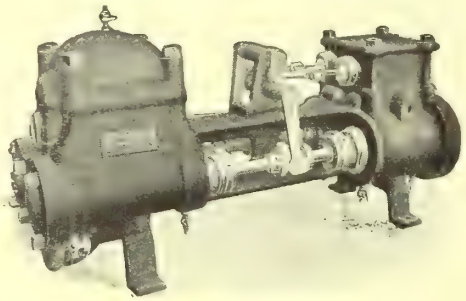

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The Publisher's Page

By B.G.N.

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Typical Canadian Grain Elevators and Their Erection*

By James Spelman **

The accompanying article discusses in a highly interesting way the various types of elevator installed throughout the Dominion, features the origination of what might be termed the inland or prairie type, and shows that those installed at our lake and ocean terminal ports have the like basic constituents, although diversified in their detail and enlarged in capacity.

DURING the war Britain will look to Canada's grain fields for food, therefore, grain handling facilities, and the methods by which grain cargoes are forwarded and trans-shipped assume an importance not approached in peace times. Perhaps the simplest way to explain the different kinds of elevators is to trace the grain from the farmer to the ultimate consumer.

Ultimate Destination Problematical

The acreage in Western Canada devoted to the raising of grain has more than trebled in the last ten years. Immense grain lands lie far to the west of the Great Lakes, and a glance at the map shows that the mere matter of transportation is one of great difficulty.

The wheat that grows during the short fierce northern summer is not for the consumption of the men who raised it, nor for his neighbors. It is sown, harvested, and carried away in freight cars without knowledge as to its ultimate destination. It must go from one storehouse to another, from freight cars to steam barges and back again, until the telegraph or cable reveals where it can finally be disposed of to the greatest advantage.

The funnel to which western grain is at last gathered is at Fort William and Port Arthur. From here, during summer and fall, it is shipped by boat to the Georgian Bay ports, such as Depot Harbor, Tiffin or Port McNicoll, and transshipped by cars to Montreal, St. John or Halifax. Again, it may be shipped by the all water route, via the lake and canal system direct to Montreal, where it is trans-shipped by the elevators to ocean going craft.

Reducing Handling Costs

What the grain will cost when it is at last converted into food will depend largely on the expense with which all this necessary manipulation is accomplished. Its bulk is so great in comparison with its value, the industries incident to its handling are on so vast a scale, that every device which saves time or energy, ever so little, assumes a first importance. Man-power is too costly even to be thought of now-a-days, so through a thousand mechanisms, simple or elaborate, cheaper mechanical power has been applied everywhere. Power takes the grain from the cars, stores it in bins, lifts it high in the air and lets it come whirling down through great spouts into the holds of ships. To illustrate the manner in which these things are accomplished, we shall follow the course of the grain from the western prairie across the continent to the sea.

The Receiving House

The beginning is simple enough; a farmer's wagon loaded with grain jolts along a country road to the nearest railway siding. Here stands what is called the receiving house, the primitive grain elevator. It is a tiny affair, considering the ground space it occupies. The typical one is 30 x 30 feet, but it runs 75 feet up into the air. Those proportions, by the way, are characteristic of the grain elevator; even the greatest of them, to the unaccustomed eye, look thin.

The farmer's wagon is driven up an incline into the building, and after being weighed is halted over the dumping sticks, by means of which the fore wheels are raised and the hind ones depressed so that the grain falls out of the back of the wagon through a trap in the floor into the boot of an elevator leg.

The latter is a device used in all grain elevators, large and small, for lifting the grain. It consists essentially of two pulleys, one in the boot, the other at the head, over which runs a belt, generally of rubber. At regular intervals along the belt, metal cups are attached, and, as the pulleys revolve, these cups scoop up the grain from the boot and carry it to the head where it is turned out, by the inversion of the cups, into a spout placed there to receive it.

In a little elevator like the one indicated the leg will carry up a thousand bushels an hour. Some legs in the large elevators at Montreal will lift twenty times as much, but the principle of operation is exactly the same. The bins, of which there are nine, are thirty to fifty feet deep, and these constitute the greater part of the building.

When the freight cars that are to carry away the grain are shunted upon the siding, the grain is drawn from the bottom of the bins, lifted again to the top of the house, weighed in hoppers, and spouted into the cars. There is nothing intricate about this, but it has been dwelt upon somewhat fully here because these are the essential operations of all grain elevators; up by power and down by gravity, into the bins and out of them again.

When the grain-laden freight cars are hauled off the siding they may be bound for any one of a number of the big interior cities. If the grain is billed to Fort William or Port Arthur, it will, in all probability, pass through Winnipeg. Here the greater part of the western crop is sampled and inspected. I will briefly outline the sample and inspection system.

Sample and Inspection System

First, a man comes along, unseals the car, and leaves a bag at the bottom of the door. A second man follows, who has in his hand a "stabber" and also a cloth. The stabber is a hollow brass tube with a second tube inside, each tube having rows of longitudinal holes. The stabber is pointed at the bottom to allow of being thrust through the grain, and it is possible to turn one tube inside the other. The man drives the stabber (closed so as not to admit the grain), to the bottom of the car, then turns the tubes to admit the grain and by this means draws out what might be termed a sectional view of the grain in the car.

He is supposed to stab the car in several different places, and each time he draws the inside of the stabber out, he empties the contents on the cloth. He can then be considered to have a fair sample of the grain in the car, but of course the sample so secured is too large for inspection, so the large sample is thoroughly mixed and about five pounds retained in a bag, the rest being returned to the car. The sealer then comes along and re-seals the car.

Inspection Highly Important

The bags of sample are next taken to the grain exchange, where the actual inspection takes place. All the three railways have large yards at Winnipeg, and when it is stated that over 1,500 cars of grain pass through there daily during the grain season, you can readily understand the work the inspection staff have to do. To quote Dr. McGill:

"The inspectors of the grain of Western Canada have no easy or unimportant task. They stand between two opposing interests, farmers and millers, the former complaining of undue severity and the latter of culpable leniency. Upon their flank is a third army of critics, the dealers, who consider the grading severe or lenient according as they themselves are sellers or buyers. They have to inspect an enormous volume of grain, and in certain seasons they must work

*From a paper before the Ottawa Branch, Can. Soc. Civil Engineers.

**President, John S. Metcalf Co., Engineers and Elevator Builders.

rapidly and continuously during daylight. They must never be bewildered either by the variety or continuity in which nature revels, or by the multiplicity of grades of which the terms are neither very distinct nor unambiguous. They have few mechanical aids. Their senses must always be keen, and their judgment always sound, for one error will be remembered against years of efficient service. Their work is of supreme importance, for their verdict fixes which rate per bushel, out of several quoted on the market, the seller will receive, and the grain is stored, transported, and sold both at home and abroad on their certificates.

"Some idea of the difficulty of their task may be gained when you consider that in 1913 there were no fewer than 30 grades of western winter wheat, 30 grades of oats, 15 of barley and 15 of flax."

If the grain is eastbound, Fort William or Port Arthur is reached by the freight cars. In that case, they will fall in with thousands of other cars just like them, and they will be jostled and bumped and shunted until at last they roll into a great concrete and steel structure, having its name across the side in big letters that can be read through an intervening half-mile of smoky air.

This is the warehouse for grain—the elevator — designated by a registered title, inspected and licensed by the government and under the more particular supervision of the local authorities. Grain must be weighed and classified before going into its bins, and once there it is as easy to deal in it in the market as it is to transfer money in a bank from one account to another. The warehouse receipt for it is negotiable; to all intents and purposes it is the grain itself.

In the elevator the cars are not allowed to wait long. They have come into the electrical atmosphere of hurry which pervades the western world of commerce. Time and space are almost priceless, so the seals are broken and the car doors rolled back, and then in a moment the grain first makes its acquaintance with the power shovel.

The Power Shovel

The power shovel is a most ingenious drum situated on a revolving shaft. A rope is wound upon this drum, and if you take hold of the end of it and walk away it will unwind easily and as far as you please, so long as you do not stop. The moment you do stop, however, it will wind up again and haul you back to the point you started from.

A big iron-shod two-handled scoop is attached to this rope, and with it the shoveler goes into the car. The moment he stops the rope jerks taut and the scoop full of grain is drawn out of the car and dumped into the boot of an elevator leg. A pair of shovelers—they work in pairs — can take out of cars about thirty thousand bushels in a day.

The operating mechanism of this shovel is simple, but interesting. The ropes are so attached to the drums that pulling out the shovel rope unwinds the chain. As soon, however, as slack is given on the shovel rope, the counterweight rope reverses the motion of the loose spool, and a lug on this spool trips a catch, allowing a counterweight at the end of the bell crank to throw in the jaw clutch. The power transmitted by the shaft now winds up the shovel drum, and at the same time winds up the chain which has been hanging in a loose loop. The length of this chain has been adjusted so that just as the shovel attached to the shovel rope reaches the freight car door, the chain is wound up tight, pulls the bell crank to the position shown in the drawing, thus releasing the clutch and leaving the drum loose on the shaft, ready to repeat the operation.

We now tell again the story of the small receiving house on the prairie, for the grain goes up the leg and is spouted into the bins just as it was before, but with this important variation that instead of one leg there are many; the cups they carry are twenty inches wide or more, and the nine bins for the spouts to fill have grown to as many score.

The Bins

We have spoken of the bins before, but they are worth mentioning again for they are, after all, the most distinctive feature of this method of handling grain. In European warehouses, so generally that the exceptions are inconsiderable, the grain is spread, several feet deep, over immense floors, or bagged; but we turn to the vertical dimension instead of the horizontal, and the grain is piled eighty or ninety feet high in narrower bins.

How long our grain will lie in these bins depends upon circumstances; but, brief, or extended, its sojourn is an active one. Not for its actual body and bulk that lies quite unmolested and to all appearances forgotten in the bin, but the other self—the slip of paper which for the time being represents it, is bandied about like a shuttlecock, and the twenty-five thousand bushels which filled the little receiving elevator to its utmost capacity is sold and bought and sold again by the mere flick of a man's finger.

We have, however, predestined that our grain shall cross the sea, so at last, when what is beneath it in the bin is drawn away and other grain is piled above it, its time comes to escape through the open door at the bottom and then be lifted in the now familiar way by the tireless metal cups and to take again the swift plunge down a big spout. The grain that left the bin just ahead of it may have been turned into freight cars and sent off to almost anywhere, but ours is for Georgian Bay ports, and the spout directs it down into the hold of a vessel.

The vessel is a clumsy barge, blunt-nosed, broad-beamed, with her single funnel located far aft. She stood high out of the water at first, but before the great yellow streams have been pouring through her hatches two hours she has settled lower and lower until the numerals painted on her bow and stern indicate that she will have little water under her keel in our ship channels.

The vessel loading is rapid, and an elevator average for the whole time loading, including stops, shut downs, etc., of 35,000 bushels or 1,000 tons an hour is by no means rare. Under favorable conditions, 435,000 bushels of wheat or 13,000 tons has been loaded in nine hours (SS. "Schoommaker," Nov. 15, 1913), and over 60,000 bushels per hour of oats has been loaded, (S.S. "T. Crown," Oct. 3rd, 1913). Finally all hatches are battened down and our boat casts off to plod, eight knots an hour, to Port McNicoll or Tiffin.

Other prows are pointed thither, and when we reach this next stopping place in our journey to the sea it needs but a glance at the crowded shipping, the other vessels, grain laden like ours, waiting their turn alongside the great elevator to which our cargo is consigned, to convince us that here as in Fort William, a single hour's delay will prove costly.

Obviously, too, here is a new problem to solve. The power shovel which made such short work of the freight cars will never do for lifting the grain straight out of the deep hold and through the narrow hatches. We are moored close by the elevator, the main hatches exactly opposite two tower-like structures, built against its side and traveling on car wheels along the dock so that they may move from hatch to hatch.

The Marine Tower

Inside of each of these marine towers, as they are called, hangs like the clapper of a titantic bell, a huge affair framed of steel, booted and sheathed with iron. We have not long to wait here beside the elevator before this monster descends, slowly and with dignity befitting its size, but still in the most matter-of-fact sort of way. A big arm of steel with a roller at the end of it is run out from below and pushes the booted end out away from the side of the tower until it hangs directly over the opening of the hold. Then down through the hatchways, down, until the boot is hidden in the grain.

What we have been watching is nothing but an elevator leg hung up bodily in the marine tower; these legs vary

from eighty to one hundred feet in length with a vertical travel of 35 to 50 feet.

The Port McNicoll marine leg, eighty feet long, weighs fifteen tons, and the sliding structural steel cross head with its boom supporting the leg, weighs 15 tons more. The operator's control is such that by manipulating clutch levers he can move this thirty tons and place the boot of the leg within a fraction of an inch of any spot in a ship's hold.

The marine tower structure is interesting, and presents problems in design not often encountered. These towers, 10 floors, one hundred and fifty feet high, self propelling along a track 450 feet long, by means of a friction drum and endless cable, are 29 ft. x 33 ft. in plan. Tied back to the storage house on one side and at one elevation only, rolling along a pair of standard gauge railway rail tracks, on 20 pairs of car wheels, the design problems in wind resistance can well be imagined.

Each tower weighs 650 tons dead weight on its trucks, of which 268 tons is structural steel; and each contains four motors of 305 aggregate horse power, driving the various mechanisms.

Grain Weighing Provision

Before the grain goes to the bins it must be weighed, and here is the manner of the weighing. Directly beneath the spout of the head of the marine leg is a receiving garner, at the bottom of which is a valve controlled by a lever. Beneath this garner is a scale supporting a hopper whose capacity is one thousand bushels. At the bottom of the hopper is a valve so that when the grain is weighed it can drop through into a lower garner.

In order to secure a proper economy of time and effort the weigher must adjust his scale beam to a standard weight, and take just that amount into the hopper at each draught from the receiving bin. The instant the scale balances, the slide is shut tight and the valve at the bottom of the hopper is opened. It is a circular valve 40 inches in diameter, and it takes 50 to 60 seconds before the 1,000 bushels has run through and the valve is locked ready for another draft. That is not difficult if you are allowed to draw it leisurely, but if you are to weigh all that the great marine leg is pumping out of the hold—twenty thousand bushels an hour—you must repeat that performance every three minutes, which is a different matter.

The elevator at Fort William was a warehouse; that at the eastern end of the lakes is primarily a transfer house, though there is an increasing demand for storage space also, as the 4,000,000 bushel capacity of Port McNicoll testifies. The grain may be stored here, but our particular 25,000 bushels is carried across the house and out again as fast as cars can be found to accommodate it.

This is our last way-station; we are going now straight to the sea, to one of the grain exporting ports; Montreal is one of them, Halifax and St. John are others.

Seaport Elevators

To understand the mode of operation in a seaport elevator, remember our Fort William warehouse. There is but one important variation; that is in the method of putting the grain into the ships. In Fort William the vessel lay right against the side of the elevator and the grain went into it through spouts; but your ocean freighter, as a rule, cannot spare time from the package freight handlers to do that. She lies at a pier and the grain, which is only a part of her cargo, is carried out to her on a belt conveyor.

West St. John is a representative ocean grain port, being the main winter grain port of Canada. The layout there is typical. The old wooden C. P. R. elevators served well until the increase in size of the liners coming to St. John made higher galleries a necessity. In the fall of 1913 when we completed construction of the 1,000,000 bushel C.P.R. fire-proof house, the necessity of higher shipping galleries was recognized, and it was determined to build the Sand Point gallery system.

These galleries were built of wood, inasmuch as they received grain from the old wooden elevators and were interconnected with the old wood gallery system. They are equipped with two 15,000 bushel conveyors from the new C. P. R. elevator to the old houses, and past them around Sand Point Basin to the end of Shed 5, one conveyor running on over Shed 6. These galleries are built 15 ft. to 30 ft. higher than the old galleries across the basin, and will load the "Empress" type of boat at all stages of tide. The construction work was carried on under most difficult winter conditions without interfering in the slightest with heavy traffic carried on at these wharves.

As St. John is the winter grain port of Canada, so is Montreal the summer grain port, and the grain which comes down the Great Lakes to Port McNicoll would most probably form part of a through grain train made up at Port McNicoll, and sent down from that port to be unloaded at the big Harbor Commissioners' Elevator No. 2. The unloading is similar to that at Fort William and the grain is quickly elevated, weighed and binned. As it is on a rush order for European shipment, it is soon drawn out, reweighed and spouted to a conveyor running out through a gallery over a freight shed.

The other grain handling devices that have been described were expedient, but they were noisy, dusty and strenuous; this one is beautiful. Without noise, without apparent effort, the grain tumbles upon the swiftly moving belt and rides out, a yellow ribbon three feet wide on the broader band of rubber, stretching out from six hundred to a thousand feet to the ship.

You have seen a man making a running dive from a springboard; that is the way the grain ends its journey to the sea. The belt that carries it rises slowly in a gradual incline to the steel frame of a tripper containing a combination of wide, small diameter pulleys; over them the belt makes a sharp bend and starts back to the elevator, but the yellow ribbon goes on, leaping free like the jet of a fountain, and without spilling a single golden kernel, without ceasing to be a ribbon, it pours silently down the black spout into the ship.

The grain in its journey from farm to sea goes through three distinct types of terminal elevators; the inland car receiving plant, such as at Fort William, where grain is received in freight car lots, cleaned, and shipped in cargo lots by lake freighters; the boat receiving and car shipping plant such as at Tiffin and Port McNicoll; and the seaport car receiving plant such as at Montreal and St. John, where the grain is transhipped from freight cars to ocean going freighters.

Inland and Seaport Elevator Types

The Port McNicoll-Tiffin type of elevator is entirely different from the Fort William or Montreal-St. John types; but a partial similarity in operation at inland ports and seaports has made some people think the same type of elevator plant satisfactory for both locations. At Fort William there must be large cleaning capacity combined with large storage capacity. This means that the ground floor of the working house will be filled with cleaning machines, and has resulted in building a track shed for receiving grain at one side of the working house, and beyond the track shed, storage bins to hold the millions of bushels of grain which is not being cleaned, but is merely to be kept in storage.

Grain is carried by conveyors from the track shed unloading hoppers to the elevator legs; by conveyors from the scales, out over the track sheds again to the storage bins; and when it is shipped, conveyors again take the grain from the storage through the track shed to the working house elevator legs. This is an economical house (especially in first cost) when built for large capacities, and is the only type that provides the cleaning facilities required at inland ports.

At ocean ports practically no cleaning is necessary, and the storage capacity required is much smaller than Fort William. The preferable type of elevator

for this work is the "through house," where the freight cars run through the house directly below the bins, instead of being unloaded in a track shed outside of the working house.

In the "through house" the grain is unloaded from cars falls directly by gravity to the boot of the elevator leg, and can be spouted directly to the storage bins from the scales. When it is shipped it is again spouted direct to the elevator legs. This type of elevator plant costs about the same as the track shed-working-house-storage type when built for a capacity of about 1,000,000 bushels, and its system of operating by gravity spouting instead of by conveyor belts is an obvious economy. In my opinion, designers and grain elevator men make a grave error when they select the track shed type of house for a million bushel non-cleaning ocean port elevator.

Grain Handling System Construction

To turn to the construction side of the grain handling system. For a long time grain elevators were built of wood, a material which was cheap and easily and quickly obtained; but the increasing cost of timber and the commonness of fires such as that at the Galveston elevator, sounded the knell of the old wooden elevator. In the old days, elevators were built almost entirely by rule of thumb; there was no accurate knowledge of grain pressures, but bins were patterned after other bins which had stood up.

However, when it came to using fireproof material, many difficulties were encountered and the tale of their surmounting would make a story in itself. Steel, tile and concrete were tried in turn, and it was early realized that a definite knowledge of grain pressures was necessary. We now know that we must provide for stresses resulting from load and friction in a granular material; but within the last fifteen years there have been those who have advocated the theory that grain pressure was fluid pressure pure and simple. Other formulae were evolved by more or less accurate experiments which gave results ranging from fluid pressure down to what is now proven the actual pressure.

It would naturally appear that bins built strong enough for fluid pressure would be ample in strength to retain a granular mass of the same specific gravity. As far as bursting pressure is concerned this is true, but due to the pressure of grain, normal to the bin wall, a large part of the grain load in a bin is carried by friction on the walls. Some steel plate tanks that were built on the fluid theory specification, simply sat down, crumbled vertically, when the grain with which they were filled developed its vertical load on the thin plate walls.

In 1914, Montreal led all seaports in North America in point of volume handled, with a total of 72,000,000 bushels of grain, and the story of its development as a grain port is partly as follows:

In 1903 the first fire-proof elevator, known as Harbor Commissioners' Elevator No. 1 was built in the most central and valuable site in the harbor, and great things were expected of the grain trade that should result. Complete barge and car unloading equipment was provided and also spouts to load out to the ocean-going steamers. In that last item lay the hitch which made the elevator show a loss in the first three years; for the ocean-going steamers would not shift from the freight sheds to come under the grain spouts of the elevator, and the tramp boats taking a whole cargo of grain, which could afford to move to this berth, were few and far between.

In 1905 in connection with the new transit sheds which were being erected, a complete conveyor system was laid out and constructed to take the grain directly to the steamer berths so that boats could receive their grain without interference with the handling of their package freight.

This was the beginning of the system that has made Montreal the premier grain port of North America. Gradually the system has been extended until now there are laid out and installed two and one-half miles of conveyor gallery containing ten and one-half miles of rubber belting, and serving nineteen vessel berths. This system of the Harbor Commissioners has a shipping capacity to ocean vessels of 165,000 bushels an hour, or in round numbers 10,000,000 pounds, or 5,000 tons an hour.

In addition to the Harbor Commissioners' plant, the Grand Trunk in 1905 designed and erected the 1,000,000 bushel Windmill Point steel elevator, which with its conveyor galleries adds 30,000 bushels per hour to the harbor shipping capacity. The boats that load there are almost entirely the tramp freighters, taking grain cargoes only.

The demand for storage facilities at Montreal grew rapidly, and, in response to this demand, Harbor Commissioner Elevator No. 2 was built. Coincident with the elevator construction, the shipping gallery system was largely extended, but all this construction could not keep pace with the harbor's needs.

In January, 1913, the construction of a 1,450,000 bushel addition to Harbor Commissioners' Elevator No. 1 was started. Inasmuch as this is one of the latest elevators and exhibits many interesting features in both design and construction, due to the restricted space available, it will be described in some detail in a later issue.

COLLINGWOOD SHIPBUILDING CO.

CONSIDERABLE activity is likely to be seen during the coming winter at the plant of the Collingwood Shipbuilding Co., Collingwood, Ont., not only in the production of new vessels, but in the matter of general repairs as well. Construction is approaching an advanced stage on the two vessels for the Imperial Oil Co., and as briefly noted in another section of this issue, an order has been secured for a large freighter, particulars of which are as follows: Length, 550 ft.; beam, 58 ft.; depth, molded, 31 ft.; gross tonnage, about 8,000; deadweight on 19 ft. 6 in. mean draft, 11,000 tons. Three Scotch type boilers each 13 ft. diameter by 11 feet long, will be installed, and the propelling machinery will consist of one set of triple expansion engines with cylinders 24 in.—40 in.—66 in. diameter by 42 in. stroke.

The vessel will be built on the arch principle with deep double bottom and side tanks, the design being such as to enable either grain or coal to be carried.

GOVERNMENT-OWNED LINE HUDSON BAY STEAMERS

A GOVERNMENT-OWNED fleet of steamers out of Hudson Bay will be established, it is understood, on the completion of the line and terminals of Canada's new northern port and will be in operation in time to carry part of the 1917 wheat crop to its destination overseas, it is hoped.

Work on the construction of the line is being expedited with a view to completing the laying of steel by the fall of next year. If this is done, as stated, the route will be in a position to compete for the movement of the Canadian grain crop of 1917. On account of the prejudice created against the route by the results of careless navigation in Hudson Bay, it is expected that insurance rates will at first be so high that it will be necessary for the Government to operate its own line of steamers. This, it may be stated, will, according to present intentions, be done.

There now remains only 100 more miles of grading to be done on the Hudson Bay Railway. The roadbed has been graded for almost ninety miles beyond Manitou, on the Nelson River and is now waiting for the steel. A bridge has still to be constructed across this river, but it will be taken up in a "knockdown" condition and will not take long to erect though the span is of considerable length.

Work at the terminals is also proceeding, while at the same time wireless stations are being placed. There will be a chain of these covering the whole route from Port Nelson to the mouth of Hudson Straits.

Principles of Laying-Off Cylindrical Intersections---IV.

By J. W. Ross

The more or less special nature of the work involved in the making of sheet metal piping has caused many manufacturers to avoid this class of work, with the result that when a job has to be handled, there is frequently considerable unnecessary loss incurred through errors in laying off material. The examples treated by the writer of this article should form a valuable reference to many manufacturers on ordinary as well as special occasions.

CYLINDER INTERSECTION ON THE SIDE OF A LARGER CYLINDER.

THE two elevation views Figs. 29 and 30, and the perspective Fig. 28, shows a small pipe intersecting a larger one. The small pipe being placed on the side of the large one, in a manner so that one side of the small cylinder is tangent to the larger cyl-

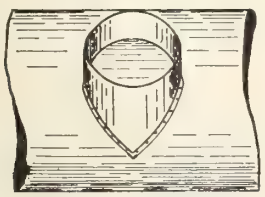


FIG. 28.

inder, while the other side intersects the cylinder. The axis or centre lines intersect each other in both views thus giving the true length of all lines parallel to each view.

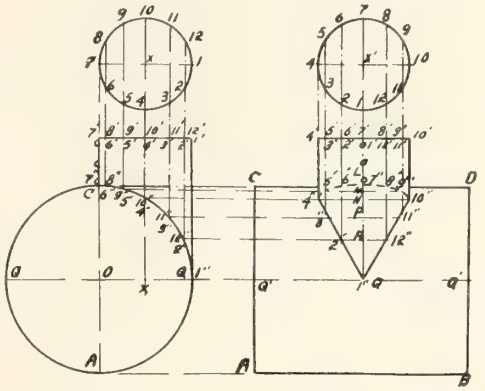


FIG. 29. FIG. 30.

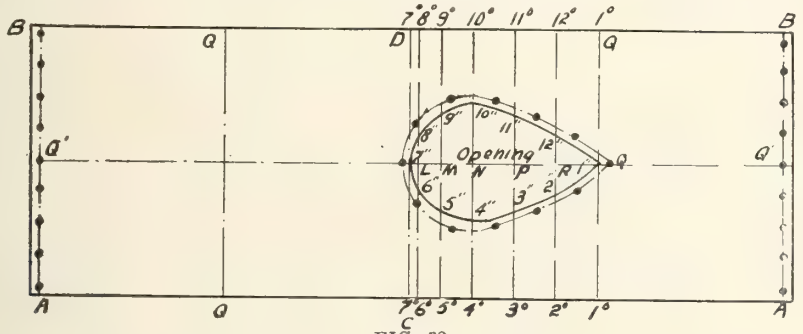


FIG. 32.

Construction.

With centre O and radius O A equal to 2 inches draw the neutral end view A Q C Q. Draw the horizontal line Q O Q. Bisect O Q at X. Raise the vertical axis or centre line X 10 at right angles to Q O Q. Parallel to this line draw the line 1^2 1^1 tangent to the circle A Q C Q. Also draw the parallel line 7^2 7^1 intersecting the circle at C^1. Measure off 7^2 7^1 equal to ½ inch and 1^2 1^1 equal to 1½ inches. Connect 7^1 to 1^1. This line is parallel to the line Q O Q. By this construction 7^1 1^2 equals 1 inch, of which 10^1 is the centre. Draw the plan view of the vertical cylinder, represented by the circle 1, 4, 7, 10. Divide into 12 equal spaces. Project these points down to the intersection of curve C Q. Project the horizontal Q O Q Fig. 29 over to Q^1 Q^1 Fig. 30. Make Q^1 Q^2 equal to 2¼ inches. Build up the elevation view A C D B around the line Q^1 Q^1. Bisect Q^1 Q^1 at Q. Erect the perpendicular Q 7. Project 7^1 1^1, Fig. 29, over to $4^1 10^1$, Fig 30. Measure off 4^1, 7^1, 10^1, Fig. 30 equal to 7^1, 10^1, 1^1, Fig. 29. Draw the circle 1 4 7 10, Fig. 30, with Y^1 as centre and radius equal to half the neutral diameter of the vertical pipe. Divide into 12 equal spaces, number, and project these points down beyond C D. Draw horizontal projectors from Fig. 29 to the intersection of similar numbered vertical projectors in Fig. 30. Number these points in relation to the intersections. Connect these points, thus defining the mitre line

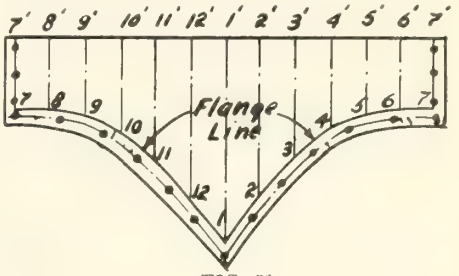


FIG. 31.

as is shown in Fig. 30, by the points 1^2 2^2 3^2 4^2 5^2 6^2 7^2, etc. Locate the points L M N P Q R at the intersection of the horizontal lines with the centre line 7 Q Fig. 30.

The Development of the Vertical Cylinder.

Measure off the stretchout 7^1 1^1 7^1, Fig. 31. Divide into 12 equal spaces. Project these points downwards. Number in relation to the position of the vertical seam. Transfer the element distances from either Figs. 29 or 30. An even

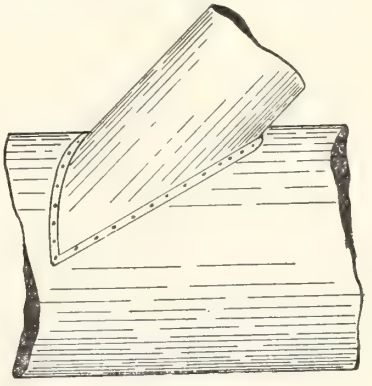


FIG. 33.

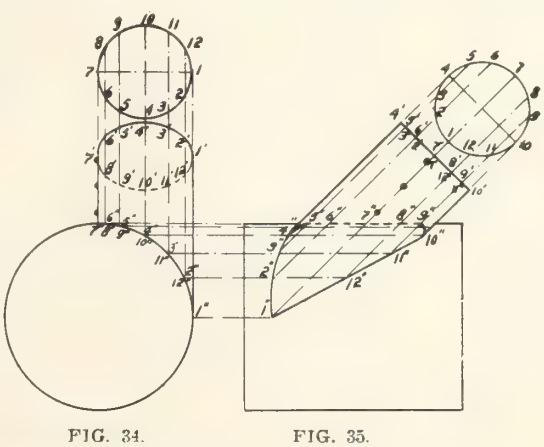


FIG. 34. FIG. 35.

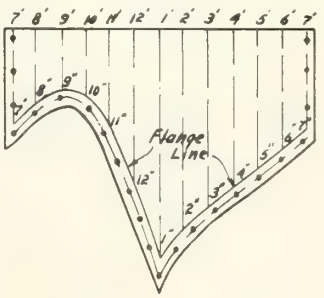


FIG. 36.

*Note: The reference letters and numerals in the text, i.e., G^2, 7^2, etc., correspond with those of the illustrations indicated as G", 7", etc.

curve drawn through these points will define the flange line. Add the laps and draw in the rivet centres. Fig. 31 shows the complete templet.

Horizontal Cylinder Development.

Measure the stretchout, A C A, Fig. 32, equal to 3.14 times the diameter Q O Q, Fig. 29. Bisect A C A at C, erect the perpendicular C D. Take the length of the divisions—along the curve—7^2 6^1 6^1 5^2 5^2 4^2, etc., Fig. 29. Transfer to 7° 6° 6° 5° 5° 4°, etc., Fig. 32. Raise perpendiculars. Bisect B A at the point Q. Draw the centre line Q Q. Locate the points L M N P Q R, Fig. 32, in relation to their positions in Fig. 30. Transfer from Fig. 30 the distances L 6^2, L 8^2, M 5^2, M 9^2, N 4^2 N 10^2, etc., to Fig. 32, as L 6^2, L 8^2, M 5^2. M 9^2, etc. A line drawn taking in all these points will define the opening of this cylinder. Draw in the rivet line. Add the laps to the seams B A. Fig. 32 shows the complete templet.

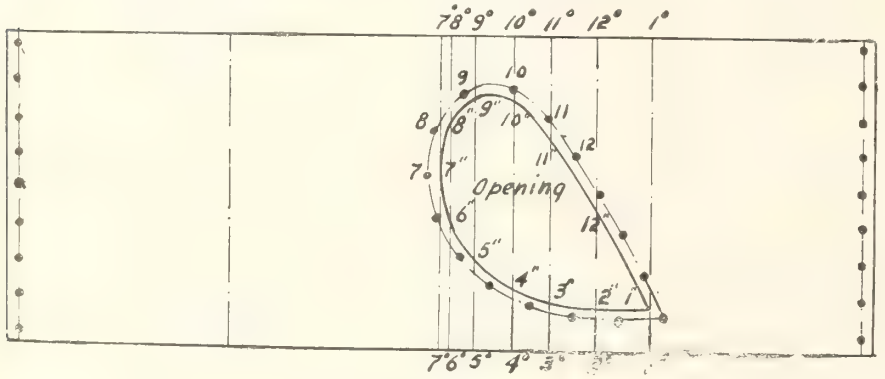


FIG. 37.

Inclined Intersection of 45 Degrees.

The perspective, Fig. 33, and the elevations, Figs. 34 and 35, show a similar problem to the preceding one. The difference being that in one of the views the pipe is inclined to 45 degrees to the horizontal pipe.

From the experience derived from the study of the previous problems, the student ought now to be able to construct this problem and develop the patterns. Your attention is drawn to the peculiar shape of the mitre line in Fig. 35, the pattern in Fig. 36, and of the opening, Fig. 37.

Vancouver Harbor Work.—Accompanied by the contractors, engineers and the Board of Harbor Commissioners, Hon. Robert Rogers made a tour of inspection of the Vancouver harbor improvements and other public works on November 16. The Minister spent several hours viewing the new Government elevator, rapidly progressing to completion, and inspecting the newly completed $2,000,000 dock fronting the elevator.

THE USE AND ABUSE OF OILS.—I.*

By T. C. Thomsen, B.Sc.

THE owners of many large plants have seen the advantage of having an engineer responsible for the lubrication of their engines and machinery, and in plants which are not large enough to justify the employment of an engineer for this particular work, it has been found advantageous to have a lubricating engineer to inspect the plant occasionally, report on the lubricating conditions, and offer suggestions as regards economy and saving in power.

Many large concerns, when inviting tenders, specify certain chemical attributes in the oil. This practice is wrong, because chemical readings do not show the lubricating properties of an oil, for the reason that it is possible to duplicate a high-grade oil on the basis of chemical tests by means of an imperfectly manufactured and inferior article. Although the chemical tests may be the same for the two oils, the results can be widely different in actual work. The only accurate way of testing lubricants is to try them under working conditions, where they are to be actually used.

High-grade Oil and Lubrication Cost

The question might be asked whether introducing a higher grade of oils would not increase the total cost of lubrication. Experience has proved that in a large number of plants the costs of lubrication over a period may even be lower than with lower grades of oil in use. In other cases the cost may possibly work out a little higher, but this increased cost will be balanced by other benefits. It is here that the services of a lubricating expert become desirable. He should select high-grade oils for the portion of the plant where such oils could be used to advantage, and if the lubricating conditions are not favorable to the introduction of high-grade oils, he may suggest ways and means by which better lubricating appliances or better methods of handling oil can be introduced, so as to make the introduction of better grades of oil possible.

When talking to men directly interested in the successful running of machinery, one is often assured that they have no trouble; the idea being that the machinery is operating without any unusual heating of bearings or engine parts. In many such plants, however, the mere change from low-grade oils to better grades has effected a saving in power of 20 per cent., and it is now realized that there is something beyond having "no trouble." A troublesome bearing in nine cases out of ten will not indicate that the oil is unsuitable, but that some mechanical defect exists in its construction. It is not an occasional hot bearing, but the few degrees of unnecessary frictional heat that are wasted in hundreds and hundreds of bearings that determine the real standard of lubrication.

Testing Influence of Better Lubrication

The actual testing of the influence of better lubrication on a power-house plant is a difficult matter, as there are so many other conditions that may influence the results. By means of accurate temperature tests it is, however, possible in nearly every case to make a comparison between the lubricating qualities of different oils, and it is recommended to make such tests as thorough and as careful as possible on specially selected important bearings. These temperature tests should be repeated from time to time with a view to controlling the quality of the oils in use. If the mechanical conditions do not change, the rise in temperature of the bearings above the surrounding atmosphere should remain very nearly constant.

When a new motor exhibits a tendency to develop heat in one bearing, the bearing should, of course, be examined. If it is found in good condition, the cause of the heating will probably be found in the thrust of the armature shaft against the bearing, which may result from either of two conditions: First, the machine may not be level, and the armature shaft may dip towards that end. Second, the magnetic centres of the pole-pieces and armature shaft may not be in line.

Where low-grade mineral oils, or oils with mineral base, but compounded with animal or vegetable oils, are employed, they will develop gumminess in the bearings, and necessitate frequent cleaning. Such cleaning is unnecessary when high-grade dynamo oils are employed; cases have been known where such oils have been in use for years without any necessity for cleaning the bearings and oil wells. However, it is desirable to empty the bearings every three or four months and put the oil through a suitable filter. It will then be as good as new, and can be used over and over again, being mixed with a little fresh oil to make up for loss.

*From a paper read before the Association of Mining Electrical Engineers.

Piston Troubles of the High Compression Oil Engine*

By George E. Windeler**

The development of almost every type of prime mover or power originating apparatus has called for the solution of problems of a nature peculiar to the principles involved. High compression oil engines of the raw fuel injection type are becoming a factor of increasing importance in power generation, and the points touched upon by the writer throw some light on troubles which beset the pioneers of this type of engine, and how they have been overcome.

IN approaching the subject of piston troubles in high compression oil engines, I have in mind that there has been a very considerable amount of research work carried out in different parts of the world in connection with the "growth" of cast iron and the difficulties with it when subjected alternately to high and low temperatures. Any remarks that I make on the subject are entirely based on the investigations which we have carried out at the works of the firm with which I am associated.

Naturally there are many points in connection with the investigations which I am not at liberty to disclose, but I will endeavour to place before you the procedure that has been adopted and the results that have been obtained step by

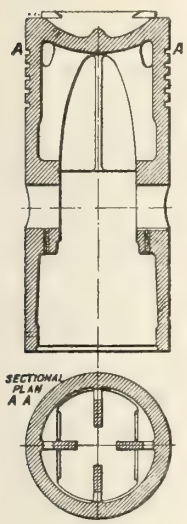


FIG. 1.

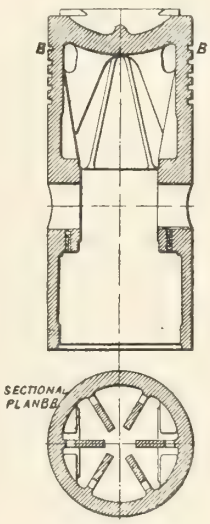


FIG. 2.

step, coupled with the modifications that have been made in design to meet the decisions that have been come to at the different stages of the investigations.

I am exhibiting a number of diagrams illustrating the different stages in the design of pistons we have used on various sizes of engines, and also a diagram, Fig. 6, showing the general arrangement of the combustion space, with the valves and piston in position, to illustrate my remarks in regard to the transmission of heat through water spaces.

Steam Engine Conditions

In dealing with the internal combustion engine as a heat motor, the points of difference between it and the steam engine are considerable. In the steam engine, to obtain the most economical results, everything possible is done to keep the temperatures of the cylinder liner, piston and ports for the incoming steam, and all surrounding spaces, as near as possible to the temperature of the live steam. To obtain the most efficient results, steam jacketing has been resorted to, latterly superheated steam, and the latest innovation has been the adoption of the Uniflow engine, which admits steam by a set of ports which are placed at one end of the cylinder, and allows the exhaust steam to pass away through another set of ports situated either at the other end, or at the middle of the cylinder, according to the type of engine.

In the internal combustion engine (in this particular instance I will deal specially with the Diesel engine) everything possible is done to keep down the temperature of the cylinder liner, cylinder cover or breech end, exhaust valves and exhaust passages which are in contact with the fuel or gases. In some types the pistons are water or oil cooled. In a well-designed Diesel engine 40 per cent. of the heat units admitted to the combustion space is absorbed in useful work. Of the remainder, 25 per cent. passes to the exhaust and 35 per cent. passes away to the circulating water and is lost in radiation, so that almost as much heat has to be absorbed by the cooling water as is developed in useful work; therefore special attention has to be paid to water-cooling arrangements to ensure that the circulation is thorough and that no air or steam pocketing is likely to occur, and special attention should be paid to the arrangements to prevent short circuiting in the water circulation otherwise certain parts are liable to become overheated locally.

How to Avoid Deposits

In the course of the investigations it was found that the major portion of the defects that had arisen on cylinder covers and pistons were due to serious deposits having been allowed to form in the water spaces of the cylinder covers and on the cylinder liners, and a good deal of time was spent in investigating the cause of such deposits having formed, and ultimately we came to the conclusion that such deposits were not formed on the liners and cylinder walls during the time the engine was working but after the engine was shut down. Naturally, the piston, cylinder cover, valves, and such parts as are in contact with the combustion space must have a large number of heat units stored in them, and when the engine is shut down these heat units are absorbed by the water which remains in the jacket, the quantity of which is comparatively small, and a very considerable rise in temperature takes place; in fact, sufficiently high in the majority of cases to throw down the salts which were held in solution in the water. We were so sure that the theory was correct (which, as far as we knew, was quite a new interpretation of the difficulty) that we wrote to the various users of our engines suggesting to them, where the circulating water was known to be of a considerable hardness, that they should run water through the water spaces for some time after the engine was shut down—with the most happy results. This information, naturally, became public, and most Diesel engine users have now adopted this system to their advantage.

I have personally inspected a cylinder cover which contained a water space about 6 in. deep and found a deposit of as much as 5 in. thick in the water space. Naturally, the cover had cracked. The

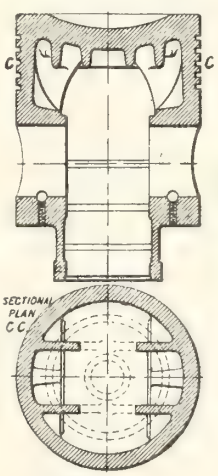


FIG. 3.

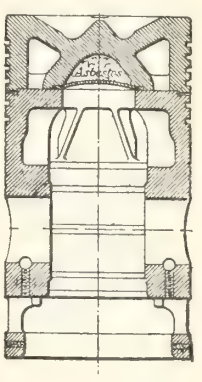


FIG. 4.

aforesaid suggestion was adopted in this particular station, and the results have been very satisfactory indeed.

In an internal combustion engine without a water-cooled piston, the heat units

*Read before the June meeting of the Diesel Engine User's Association.

**Chief Engineer, Mirrless, Bickerton & Day, Ltd.

that have been absorbed by the piston crown must, out of the necessity, be dispersed from the crown down the body of the piston, and passed away through the liner to the water space by the contact that the piston forms with the liner. It is therefore necessary to study carefully the design of the piston head to obtain the best results. At the same time the piston must be designed in such a way that the load that is applied to the crown shall be transmitted to the crosshead pin which attaches to the connecting-rod, without causing any distortion to the piston, which has to maintain its roundness to enable it to work without trouble in an accurately-bored cylinder.

Piston Material

In the small internal combustion engine such as is used on automobiles and air-craft, there is quite a difference of opinion as to whether cast iron or oil-tempered steel is the most suitable material to use for pistons. One would almost imagine that the oil-tempered steel piston would be the most suitable for such machines, where high power is developed in comparatively small cylinders, and at a high rate of revolution; but for large engines such as we have under discussion it is necessary to have a fairly heavy section of material to enable the heat units to pass away in the time available, so as to prevent undue heating of that part of the piston which is in contact with the gases.

In diagram No. 1 is shown a piston with the usual dished top, and which is supported by four radial ribs, two ribs being carried down to the piston pin boss so as to form a more or less rigid connection between the piston crown and the piston pin, to enable the forces to be transmitted direct with the minimum amount of distortion. It will be noted that this piston is comparatively thin in the crown and in the body, and when fitted to a number of engines, was found to work admirably; but ultimately distortions appeared between the ribs, and it was deemed advisable to modify the design to that shown on Fig. 2, in which six radial ribs are carried well down the body of the piston from the crown, two being carried to the piston pin boss, with a thicker rib behind the main rib to assist in the transmission of the load. The piston crown was made slightly thicker, and generally this design has been satisfactory, but at times cracks have developed in the piston top, sometimes the cracks having taken a circular form round the base of the centre cone which is formed in the piston. Such cracks, however, are not of serious import, and pistons which have cracked in this manner have been in use for twelve or fifteen months without any trouble, a slight blowing past taking place when starting up, but which ceases after the piston top has become heated, evidently the expansion closing up the crack. But a more serious state of affairs exists when the piston cracks either radially or diametrically, as it is liable to cause seizures in the cylinder owing to the piston losing its rigidity, and consequently its symmetry. It is desirable under such circumstances to immediately shut down and remove the piston.

The diagrams 1 and 2 refer to a piston 12 in. in diameter; diagram 3 shows a piston 20 in. diameter, the design of which was similar to the 12 in., but the piston crown was supported by a number of circular ribs projecting into the interior of the piston. Radial ribs were also carried down from the crown of the piston to the piston pin boss. This piston at first appeared to be quite satisfactory, but it was noticed on examining a number of castings which had been unmachined that sight cracks had taken place across the tips of these ribs, and on examination it was found these cracks had been set up by the cooling of the casting.

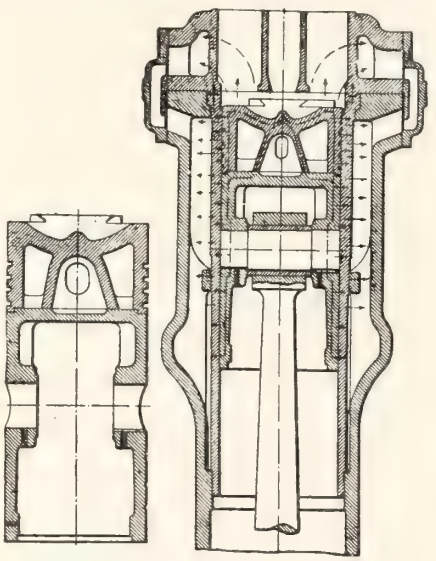


FIG. 5. FIG. 6.

Novel Piston Design

A number of such castings were broken up and found to contain many flaws. It was therefore decided to cast the piston in two portions, and diagram 4 illustrates the type of piston which is now generally adopted by the firm. The construction of the upper portion of the piston is secured to the main body of the piston by six or eight square necked studs; the object of the square-necked stud, which fits into a square hole in the body of the piston, is to ensure that the stud itself will not come out or get slack when the engine is at work.

The design of this piston top is somewhat novel, insomuch that there are no ribs embodied in the design, the support to the crown of the piston top being obtained by throwing out a conical cylindrical chamber which also has the advantage that it forms another lane by which heat units can reach the body of the piston for transmission to the water spaces. It also permits of uniform expansion. The upper portion of the piston is carefully bedded on to the lower portion, and care has been taken to have sufficient contact area to allow for rapid heat transmission. The internal cone thus formed in the head is filled with asbestos to prevent the heat being thrown down from the crown of the piston on to the connecting rod bearing. This design has several advantages, one being that different quantities of material may be used for the upper portion of the piston and the lower portion. The other is, that should any cracks develop, it is a comparatively simple and inexpensive matter to replace the top. As will be readily understood the lower portion, which acts as a crosshead, must necessarily be of a quality of iron which is hard and which will attain a high polish when running, and not wear readily; the upper portion should be of a material capable of resisting heat stresses. Diagram 5 shows a similar design as adopted on the 12-in. pistons.

Systematic Research

When these modifications were carried out, a number of experiments and analyses were made by our laboratory with the different qualities of material used, and careful records were taken of such, and when any defects developed we were able to trace the particular quality of material that was used. By this comparative method we were able to arrive at a more or less definite conclusion as regards the quality of material which best suited the purpose. Ultimate experiments proved that cast iron containing high percentages of phosphorus were most unreliable, and further investigations proved that the eliminations of phosphorus would, to a large extent, remove the difficulty of cracks developing. Great care is taken by us in controlling the mixtures that are used, and each batch of pistons and cylinder covers, liners, etc., is carefully analyzed, and records taken by our laboratory so as to ensure consistency of the material as desired.

Reverting to the question of seizures of pistons, we have formed the opinion that almost invariably these seizures are due to heating of the piston pin and its bearing, and from our investigations we have found that such seizures take place almost immediately after starting up. The opinion we have formed is that, when an engine has been set to work and shut down, the heat stored in the piston body is thrown down and tends

to evaporate the oil in the top end bearing, with the result that when the engine starts up again, this particular bearing is not amply supplied with lubricating oil, and seizures take place. Again, running the circulating water through the engine after shutting down tends to minimise this difficulty.

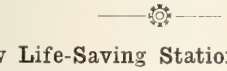
In the enclosed type of engine, where forced lubrication is used, this difficulty is to a large extent removed by the fitting of a hand lubricating pump by means of which lubricating oil under pressure can be pumped to all the bearings, including the piston pin bearing, whilst the engine is being barred round into its starting position before being started up.

Cause of Seizures

As a proof of the contention that the heating of this bearing is generally the cause of such seizures, it may be mentioned that the abrasions generally show seizure to have taken place at four points of the circumference of piston and liner, and if a careful note is taken of the position of these abrasions, it will be found that they occur at the point where the piston pin bosses join on to the thinner section of the body of the piston. At this point there is a comparatively sudden reduction in the section of material, allowing one portion of the piston to be extremely rigid, and the other portion more or less flexible; when seizures take place the piston pin becomes overheated, and by reason of its friction fit in the piston body, plus its greater coefficient of expansion, causes an extension to take place, which forces the piston out of shape, flattens the crosshead portion of the piston body, and causes distortion to occur at the four points referred to. If the engine is not shut down quickly, other seizures are liable to occur, but the main seizures will almost invariably be found to occur at these four points.

When piston seizures do occur, it is desirable that the connecting rod bolts should be carefully examined, as extension of the length of the bolt is likely to take place, and if examination is not made, ultimately fractures of the bolts are likely to occur, with most disastrous results.

Fig. 6 shows the general arrangement of the combustion space with the piston in position, to illustrate the transmission of heat to the water spaces.



New Life-Saving Station.—The Naval Service Department, Ottawa, has completed the erection of new quarters for the permanent life-saving crew at the station at Point Pelee on Lake Erie. This is an important station, since all the shipping passing through the Detroit River goes by the narrow channel between Point Pelee and Pelee Island.

CORROSION OF STEAM BOILERS

By C. E. Stromeyer.

CASES of severe corrosion are often reported where nothing injurious can be detected in the feed water, but on closer examination it very generally transpires that these boilers are occasionally laid off without being properly prepared, and they are then exposed to several serious attacks. There is, firstly, the probability of a severe internal attack, due to moisture which may have remained in the boiler, and to the abundance of carbonic acid to be found in stokeholds. Added to this, most waters contain at least traces of common salt and of chloride of magnesia, and both are very powerful corrosive agents in the presence of moist air. Possibly, too, the sulphurous acid fumes which are disengaged whenever red-hot ashes are slaked, find their way into the adjoining empty boiler, which is then subjected to the combined attack of atmospheric oxygen, carbonic acid, moisture, salt, chloride of magnesia, and condensed sulphurous acid vapours.

Quite recently some severe pitting of boiler tubes had to be investigated, the assertion being made that sulphuric acid from the waste gases had somehow got into the boiler water, for the rust taken from the pit holes was strongly charged with sulphate of iron. There could certainly be no doubt about this fact, but on visiting the works it was found that whenever a tube had pitted through, it was drawn out of its boiler and laid aside in a space into which there was a strong leakage of waste flue gases, which, as usual, were heavily charged with sulphurous acid. This acid had been absorbed by the spongy rust of the pit holes, where it was converted into sulphuric acid. The scrapings of any tube which had just been drawn contained no traces of sulphuric acid. This simple case shows the nature of the activity of the noxious vapours to be met with in stokeholds; they are absorbed by moist rust which lodges on the plates.

Preventing Internal Corrosion

To prevent internal corrosion in idle boilers these should be emptied and dried, trays of unslaked lime should be placed inside, and then all the manholes and other openings should be hermetically sealed. The lime will very soon absorb any moisture, carbonic or sulphurous acid which may be in the boiler, and any remaining salt or chloride of magnesia, being dry, can do no harm.

Formerly it was a very common practice to fill idle boilers with water which had been charged with soda, caustic soda, or lime and no doubt internal corrosion can by these means be prevented, but the chances are that very severe external corrosion will now occur. The water in the idle boiler being cold, its flue surfaces, where they are exposed to leakages from the flues of adjoining boilers, will condense moisture highly charged both with carbonic acid and sulphurous acid, and external corrosion will progress rapidly.

If, for instance, the atmosphere is humid, due either to fog or rain, then the flue gases of adjoining boilers will contain not only this moisture but a large addition due to the combustion of the fuel, and when these gases come into contact with a cold surface and are cooled down again to the temperature of the outside atmosphere, all the added moisture, which may amount to 3 per cent., will be condensed, as mentioned above, and cause corrosion. This is not a mere speculation, but an experience which is frequently confirmed with economisers. With them the inlet end of the pipes, which, of course, contain only cold water, act as condensers of flue gas moisture, and waste away very rapidly.

In some works it is necessary to have one or more boilers always ready for starting, and then, of course, they had best be kept filled with water containing a little caustic, but in all such cases it would seem desirable to devise some flue by-pass arrangement whereby the idle boiler could be kept sufficiently warm to prevent condensation.

External Corrosion

External corrosion occurs as a rule when boilers are idle, though several conditions will have to be referred to of corrosion under working conditions. The outside of a cold boiler is exposed not only to all the attacks of cold iron work, but also to the additional attacks of moisture in damp brickwork and flue dirt. This moisture is invariably associated with carbonic, sulphuric, and other acids produced by the combustion of coal, which are absorbed by porous substances. It is no exaggeration to say that external corrosion, when it does occur, is far more serious than internal corrosion, and instead of dispensing with inspections of idle boilers these ought to be watched even more carefully when at work.

Damp Seatings and Boiler Coverings

In some works boilers have been set so low in the ground that during rainy seasons the ground water soaks into the setting walls, or even floods the lower flues. Under such conditions there is serious danger from external corrosion. Short of raising the boilers to higher levels there is generally no remedy for this state of things, yet every effort should be made to change it, for the resulting corrosion cannot be stopped. The best that can be done is to record its progress and condemn the boiler when the corrosion has advanced far enough. This shortening of the life of

a boiler should, of course, be charged to its working expenses.

Another reason for urging that these conditions should be remedied is that dampness in a flue not only cools the waste gases, but also overloads them with moisture, so that the draught, and with it the power, of a boiler is reduced, This reduction, as it militates against efficiency, will reveal itself in the coal bill, if this is compared with the output as measured by the feed meter.

Dampness Under Boiler Coverings

This is also a serious matter, as the resulting corrosion is entirely hidden from view, unless the covering is removed occasionally. While a rather expensive operation, and although in the majority of cases the exposed boiler plates are found to be perfectly sound, yet occasionally old boilers are found to be so deeply and widely corroded under their coverings that the only wonder is that they do not explode before being exposed, their owners having to thank the marvellous tenacity of iron and steel for their escape from serious blame. Such cases, even though they are comparatively few, make it incumbent on all who are responsible for the safety of boilers to assure themselves by the best possible means that this form of corrosion does not exist. It is, as is well known, due either to drippings from roofs or steam pipes, or shell plate leakages.

Corrosion due to leakages are generally of a very local character. If the leakage is of the nature of a fine jet of steam or water, and if this jet is directed against the boiler plate, it is usually gouged out to a great depth. Such local leakages do not exactly endanger the safety of a boiler, but should be stopped as soon as they are noticed. because they may penetrate the plate and necessitate laying off the boiler just when it is wanted.

It has been mentioned that boiler plates if covered with scale or grease on the inside, and exposed to very intense heat on the outside, are eaten away by the sulphurous acid carried by the flame, which acid is due to the combustion of the sulphur in the coal. Copper fireboxes are also attacked by sulphur. but at a comparatively low temperature, and, in order to give locomotive type boilers a long life efforts should always be made to feed them with fuel which contains a minimum of sulphur.

Toronto, Ont.—It is announced that the Canadian Tygard Engine, Ltd., has purchased the old Ontario House, 942 Kingston road, for a factory, where aeroplane and submarine engines may be manufactured.

CANADA'S LAKE MARINE

THE question of the suspension of the coastwise shipping rules, which has been several times discussed in these columns recently, seems likely to be a less active issue in the lake grain trade this autumn than was anticipated. A lack of ocean bottoms at Montreal has caused such a rush of grain through Buffalo and New York that the price via the latter port has advanced above the Canadian route. So long as this condition lasts it is not a reasonable business proposition for application to be made for suspension of rules to allow American vessels to come to Montreal when there are higher rates to Buffalo. In fact it is doubtful if Canadian shippers would make complaint if such a step were taken under such conditions—except as a matter of principle.

When this objection of the Canadian shippers to the suspension of coastwise navigation rules was previously aired, a semi-official statement was made from Ottawa which, while dealing comprehensively with the whole situation as between American and Canadian traffic under normal conditions, seemed to evade the particular point at issue. Canadian shipping interests are not particularly concerned as to whether they deliver at Montreal or Buffalo as they will naturally go where they can get the best rates — this year Buffalo seems to have the attraction. What they do object to is a suspension of the rules in favor of American boats operating from Canadian ports to Canadian ports in direct competition with Canadian interests. Our understanding is that Canadian boats are never allowed to take cargoes from one American port to another.

The contention of the Canadian shipping interests is that if there is to be a successful Canadian lake marine it must have protection. If the rush of grain had been to Montreal this year the issue as to the coastwise ruling would have been a very important one; as it is the question has hardly come up at all. Canadian boats usually have a hard summer season on the lakes as compared with American vessels with more varied business. American boats get a share of the American grain crop before Canadian wheat is moving with the result that when it comes to the close of a normal season they have a good chance to get in and cut rates if there is a good call on bottoms to Montreal and if the navigation rules are suspended in their interests. That the Canadian carriers should object under these circumstances is not surprising, especially as it is pointed out that the application for suspension is usually made by a dealer who has allowed his judgment to get him into a corner rather than as the result of a general agitation. Canadian interests contend too, that Canadian tonnage can keep the Montreal port facilities quite busy.

REFACING RUBBER PUMP VALVES

WHEN a pump valve becomes unevenly worn, the natural result is a leakage. To overcome this, the valve must be either replaced by a new one or else the old one must be refaced. Many methods for refacing worn valves have been tried out, and probably the most common, is that of the use of a diamond point tool in connection with a high speed lathe. This procedure will always give satisfactory results, but as the tools required may not be available in many small plants some other method must be resolved to.

In the accompanying sketch is shown a device employed in a small plant and the writer has found it to be satisfactory in every particular. Fig. 1 shows the valve holder, this being simply a clamping fixture. The valve is securely held by the plate (b) and bolts (a). It has been found advisable to place two valves in the holder refaced, this obviating any rocking tendency during the facing, operation.

The cutter and its holder are shown in Fig. 2 The cutter is made of flat,

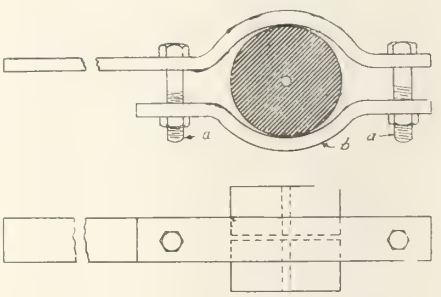


FIG. 1. VALVE HOLDING DEVICE.

tool steel with the cutting edge ground as shown. The holder is of steel, one end being made to suit a drill press spindle while the opposite end has a slot in which the cutter is placed, and held securely by two small set screws.

To reface a valve, the latter is first secured in the holder and placed on the

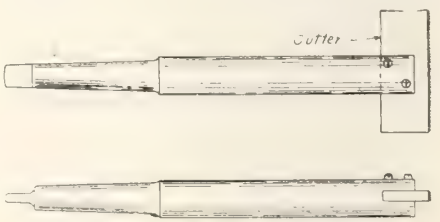


FIG. 2. CUTTER AND HOLDER.

drill press table. The cutter being placed in position and brought down against the valve, only a slight pressure and a few revolutions of the spindle is required to turn down a worn valve face to a fairly smooth surface. With the further use of very fine emery cloth an absolutely watertight job results.

Dominion Wreck Commission Inquiries and Decisions

Following the proceedings of a vessel stranding or collision inquiry is fascinating alike to the mariner and landsman. Much food for thought is always available, and in not a few instances it seems well nigh impossible to reconcile our conception of disaster prevention achievement when confronted with a detailed recital of the circumstances which contribute to many marine tragedies, not only in our own waters but the wide world over.

S S. "LADY OF GASPE" STRANDING

A FORMAL investigation into the causes which led to the stranding of the SS. "Lady of Gaspe," at or about one-third or half a mile east of the Quebec Bridge, on the north shore of the River St. Lawrence, on the 13th October last, was held in Quebec on the 20th October, 1915, before Captain L. A. Demers, F.R.A.S., F.R.B.A., Dominion Wreck Commissioner, assisted by Captain Charles Koenig and Captain L. R. Demers, acting as nautical assessors. The owners and master were unrepresented by counsel.

Master's Evidence

The master, J. B. Deslauriers, the first witness called, stated that the "Lady of Gaspe," was an iron built schooner rigged vessel owned by the Gaspe Steamship Co., with compound engine, capable of a speed of nine and a half miles per hour, drawing 13 feet forward and 15½ feet aft., carrying a crew of 32, including one certificated officer besides himself. She was of 1,199 tons gross and 705 tons net, her official number being 78554.

He said that they left Montreal at 8 p.m. on October 12, and about 7.30 a.m. of the following day, seeing a fog coming, he put the engines to standby. They were at this time off St. Bazil, and proceeded at half-speed and slow, the tide then being flood, one hour from high water. When the north end of the Quebec bridge was sighted about a point on the port quarter, the ship's engines were placed at half-speed. Shortly after, upon land being perceived, the order of port was twice given, but the ship touched. The engines were stopped; but no attempt was made to go astern. As some time afterwards the engineer reported the ship was making water fast, the boats were lowered in readiness with the object of transferring the passengers; but they were not used as a tug was sent by the owners for that purpose.

He further stated that the second officer acted as a pilot and gave instructions with regard to the navigation of the ship from Montreal to Quebec at least.

Second Officer's Evidence

The second officer, who holds no certificate, corroborated the master's evidence in so far as weather conditions were concerned; but added that he gave instructions with regard to steering and courses. He did not look at the compass but steered by objects such as lights, etc. He did not know what error existed in the compass, and stated that the course he was steering when passing the bridge was E. by N. He did not know whether the captain had detailed a man on the lookout, nor whether there was one; but the fog signals were sounded. He averred that the ship lies as she grounded and he found that she is now heading E. by NE., but cannot account for this. He intended to anchor and steered in close in order to make the wharves.

Wheelsman's Evidence

The wheelsman said that he relieved the wheel some five or ten minutes prior to the grounding, finding it starboarded, and he received the order to port twice and the ship grounded. He did not know how she was heading at the time; but thinks she altered a point under the port helm.

The lookout man, who was sixteen years of age, stated that he had been four months on the "Lady of Gaspe" as sailor, wheelsman and lookout; that he was at the wheel from six o'clock until ordered to notify one man from the main deck to relieve him. Meantime the ship was being steered by the second mate. He then went on the lookout but did not see land through the fog until after the grounding.

Engineer's Evidence

The engineer was the last witness called. He said that some ten minutes after standby was ordered he came on deck, but did not notice the weather conditions. Various orders were given and executed. At the time of the grounding he said the engines were going about half-speed, which would be about seven knots.

Finding

The evidence in this case again brings to the attention of this court the peculiarly unseamanlike navigational system which appears to prevail on certain types of vessels.

Firstly, we notice that logs are kept, but very little importance seems to be attached to them as there is not sufficient information contained in them to verify the statements made before the court. Any copy book at hand seems to have answered the purpose as a log book, the owners in this case, evidently looking upon such important documents with a marked degree of indifference.

Secondly, we cannot help expressing our astonishment at the fact that the master, through the system adopted on board this vessel, was subservient to the instructions and directions of a so-called pilot,—the second officer, who was without a certificate of competency of any kind.

The court heard the master say that he spoke to the "pilot," or second mate about anchoring before they reached the Quebec Bridge; but evidently the so-called "pilot" deferred the anchoring to a later period with the result that he came to grief, although he, the "pilot" stated that he sailed or steered a course to get near the wharves in order to anchor, but apparently only when he himself though proper.

The said "pilot" proved to be a man who was not even versed in the most elementary navigational duties, and showed lack of knowledge of distances. In the opinion of this court he was not a person to be entrusted with any duties respecting navigation. The master appears to be an intelligent man, anxious to do well; but was unfortunately influenced by the conditions indirectly imposed upon him by the management. Since, however, he was satisfied to submit to a system which he must have known to be of a pernicious nature, he must accept its responsibilities.

The ship having a number of passengers on board it was the duty of the captain to assert his authority, and order the anchoring of his vessel in the vicinity of St. Bazil, when he saw the dense fog approaching him. Having failed to do so, and being aware of the eddies forming around the piers of the Quebec Bridge, which had a tendency to cause bad steering, he should have taken a broader course passing more in the centre of the channel. It is shown that they must have passed one hundred and fifty feet at the utmost from the north pier, whilst at that place there is a width of one thousand eight hundred feet between the two piers.

The court cannot come to any other conclusion than that the grounding of this vessel was due to lack of prudence and bad navigation on the part of the master, whom it holds solely to blame, and therefore suspends his master's certificate, No. 7253 for a period of one year from October 20th, 1915; but recommend that a mate's certificate for passenger steamer and fore and aft rigged sailing vessel in the coasting trade be granted to

him from April 1st, 1916, until expiration of his term of suspension. As the second mate has no certificate we cannot deal with him.

The court wishes to remark that in its point of view, the employment of an officer without a certificate, or even with one, with a verbal understanding that he is to act as pilot and advise the captain, deserves condemnation, as the influence of such arrangements is contrary to all common sense and is fraught with danger owing to its effect on the mind of the master, who, when he has secured an appointment must, even though conscious of the illogical system, submit to it in order to retain his position. We have every sympathy for a master who find himself tied down to such conditions; but we, nevertheless, in accordance with our duties, hold him and him alone responsible for any mishaps.

If a master takes command and is unacquainted with the route he should insist that a properly qualified pilot be engaged, irrespective of cost to the owners, and we are of opinion that the sooner the owners of small craft plying the St. Lawrence in charge of master unfamiliar with the conditions existing, are made to realize that the economy practised in this manner is not conducive to safety, the better it will be for the reputation of our great ocean highway.

The court is also of opinion that under such circumstances the owners should be called upon to defray the costs of investigation, as in this case they are indirectly responsible for the mishap.

NAVIGATION AIDS WITHDRAWAL

ALTHOUGH lights at all principal shore stations will be continued in service until after through navigation has ceased for the season, Inspector Woodruff of the 11th U.S. Lighthouse District is announcing dates on which other aids in the Detroit district will be taken out of commission.

All gas buoys in East Bar Point and West Bar Point channels, Detroit River, will be withdrawn about December 5, except the East Channel gas buoy No. 2, Bar Point west channel gas buoy No. 1 and Livingstone channel gas buoys 8a, 13a, 12a and 17a. With these exceptions, all other gas buoys in the Detroit and St. Clair rivers and Lake St. Clair will be removed about December 10.

All gas buoys will be withdrawn from St. Mary's River after November 28, although the more important buoys will be retained on their stations until the latest practicable date.

In Lake Superior all gas buoys will be withdrawn about December 1. Isolated light stations at Granite Island and Stannard Rock and the Manitou Light Station will end service about Dec. 3. Passage Island and Rock of Ages light stations will close about December 12. Outer Island light station about December 14 and all other Apostle Island stations between December 5 and December 10.

Gas buoys in Lake Huron, Saginaw Bay and the Straits of Mackinac will be removed between Nov. 12 and Nov. 25. The light vessels on Poe Reef and Martin's Reef will be withdrawn about Dec. 5, that being the date also for discontinuing the service of Spectacle Reef light station.

The Lake Huron and Bar Point light vessels will be taken from their stations about December 1.

The dates given will be adhered to as closely as is consistent with conditions.

REFRIGERATION ON BOARD SHIP

A NUMBER of prominent naval and shipbuilding officials were present at East Pittsburg, Friday, October 29, to witness the test of a new refrigerating unit. The machine has been invented by Maurice Le Blanc, the originator of the well-known "Le Blanc" condenser, and is being marketed in the United States and Canada by the manufacturers, the Westinghouse Machine Company.

The question of refrigeration on shipboard, particularly on battleships, has always been one of importance, and it is predicted that this machine will greatly aid in solving the problem. A particular feature of the apparatus is the absence of all chemicals or compressed gases, such as carbon dioxide, ammonia, or sulphur dioxide, all of which are commonly used in connection with refrigeration. This will be the more readily appreciated when the scarcity of chemicals due to the war is recalled. The presence of tanks of carbon dioxide under pressure is always an element of danger, particularly on battleships when likely to be struck by an enemy projectile.

Among the other advantages claimed for the machine are small space and light weight, simplicity of operation, high efficiency, and the fact that the cooling of the water or liquid is accomplished in the machine itself without the use of a cooler. The test was, we understand, entirely satisfactory.

OIL LEAKAGE FROM RING-LUBRICATED BEARINGS

THE leakage of oil from a ring-lubricated bearing may be due to several causes. Sometimes oil leaks through the horizontal keep joint of the bearing. The best remedy for this is to place a lead wire as packing in the joint. Bearings on large motors and generators often have a deep groove in the bottom half of the bearing, which groove, at both ends, communicates with the oil reservoir, and returns such oil as may have reached the joint by splashing out from the well through the motion of the lubricating rings.

Sometimes leakage will be observed along the shafting. It is important that there should be good clearance between the outer lip and the shaft, and if it is too close a fit it should be eased. If the oil still has a tendency to creep along the shaft, an oil-thrower can be made in halves and fitted on the shaft, or it may simply be a piece of steel wire bent round the shaft and clinched so that it will keep its position. Grooves in the bush will arrest the greater part of the oil, whilst the remainder is thrown off the collars. The keep may be fitted with an internal lip, which prevents oil splashing out through the joint.

Ring lubrication is very effective, as the oil is continuously lifted by the ring or the rings over the shaft, and finds its way into the oil-distributing groove, whence the film of oil between the shaft and the bearing is kept amply renewed. Care should be taken that the oil-carrying grooves are well rounded in the direction of rotation, to facilitate the entrance of the oil between the frictional surfaces.—T. C. Thomson.

RUSHING HUDSON BAY RAILWAY

WORK on the construction of the Hudson Bay Railway is being rushed to make connections with Port Nelson next fall. The steel track is laid for 242 miles from The Pas, over which a weekly train service is operated. The building of the bridge at Manitou Rapids over the Nelson River is expected to be finished early in February, when steel-laying will be resumed.

The material for the bridge at Kettle Rapids is being taken overland this winter. This place is ninety miles from Port Nelson and the engineers are confident they will make exceptionally fast time on the balance of the construction to the bay.

Hon. Frank Cochrane, Minister of Railways, has sent out word that the road must be into its Hudson's Bay terminal by next fall at the latest and, acting on this order, the engineers are straining every nerve to make good.

Car Ferry Contract.—It is reported that the Davie Shipbuilding Co., of Levis, has closed a contract for the construction of a large car ferry for use in British Columbia. It is understood that the ferry will be used by the Canadian Northern Railway, and will carry twenty-five cars of the largest size.

CONTEMPORARY WAR ARTICLES

Embracing Information and Data Drawn from a Variety of Sources Relative to and Arising from the Prosecution of this Many-Sided European War

THE WORLD'S GREATEST ARSENAL

THE vast contracts received by various corporations in Canada and the United States have impressed most people by reason of the number of workers required to complete them, as much as by the value of the amounts involved. The fact that these contracts have been distributed over wide areas, has so detracted from their direct appeal to the general public, that an account of conditions pertaining in a restricted area like the valley of the River Clyde in Scotland is of absorbing interest to those of us engaged in munitions manufacture. The Glasgow Herald publishes the following particulars of wartime activity:

It must have been borne in upon every Clyde workman that the vast steel and shipbuilding area which exists between Motherwell and Dumbarton is one of the most extensive and important in the eyes of the nation. The Clyde area has become, indeed, the largest centre in the world for the production of war materials. This compliment is paid, notwithstanding the great developments which have taken place on the Tyne, at Barrow-in-Furness, Sheffield, Woolwich, etc. In the number of industries and the comprehensive scope of their productivity the Clyde has become the world's greatest arsenal. With the development of aircraft, too, the tendency must still be in favor of concentration on the Clyde and adjacent areas. The South of England is much too exposed to the menace of aircraft. Woolwich Arsenal and the Portsmouth and Devonport shipbuilding yards may be said to have seen their day. Once peace is concluded there will be an exodus for the north, where already some striking developments have begun in this direction, of which it is impossible here to speak. The Clyde is certain still more to outdistance all rivals in its importance as a naval and military centre of production.

Over 150,000 War Workers

It may surprise Clydesiders to discover the extraordinary number of men who are engaged locally in the shipbuilding and allied industries. At last census (1911) almost one-quarter of the males resident in Lanarkshire were engaged in such kindred trades. Lanarkshire's industries monopolized the labor of 212,482 mules. Miners occupied premier place with 56,209 men employed, while the steel trade had 20.168 workers, and the engineering shops required the services of 20,145, and shipbuilding 14,528 —a gross total of 54,841 in the steel and shipbuilding trades alone. This excludes Dumbartonshire, Renfrewshire, and North Ayrshire, all of which impinge on the Clyde munition area. Since the war began new munition factories have been laid down in many districts within the area, enormous developments have taken place in shipyards, gunshops, etc. Adding the men within the Dumbartonshire and Renfrewshire sections, plus the men engaged in the new workshops and factories, there cannot be less than 100,000 workers engaged in the Clyde area today on Government work, while the number of females may be set down at 5,000.

The Wages Bill—£600,000 a Week

Taking the men's wages at £3—an average balance between the smaller earnings of the unskilled laborer and the fat earnings of the skilled worker, swollen by abnormal overtime—this gives an influx into the Clyde area of £300,000 weekly in wages for the men, and, at £1 10s per head, the females take £7,500. In many cases unprecedented wage bills have been earned. Young, energetic fellows, having their time-sheets marked double time for Sunday labor, etc., have been known to earn £7 10s in a single week, while many steadily earn from £5 to £6. It is stated that one Clydebank family of five or six sons, plus the father —all skilled workmen—is earning £40 weekly—which is at the rate of £2,000 a year.

The total sum distributed by the Government in prosecuting the war is £4,500,000 daily, or £31,500,000 a week. It is well-known that in warships and war material the wage bill represents about one-half of the total cost (on battleships the wage bill is actually 60 per cent. of the total). On this basis, Clyde industries are receiving a total of over £600,000 weekly. In other words, almost one-fiftieth of the money expended by the nations on the war is finding its way into Clyde channels. This is proof, again, of the enormous importance of the West of Scotland to the nation—and the Allies —in the prosecution of this gigantic struggle.

A Shipbuilding Record

Leading up to this present-day abnormal development, the Clyde had already been for a number of years the largest and most comprehensive war arsenal in the world. For a long period it had been the largest warship-building centre extant. On the Admiralty List were five yards capable of producing battleships, while no other centre possessed more than two. For a number of years prior to the war the Scottish river had constantly on hand, in varying stages of construction, as many as four battleships of the Dreadnought type, representing, with a host of auxiliary craft, as much as £17,000,000 of taxpayers' cash. When Mr. Churchill visited the district several years ago he declared there were as many ships then building on the Clyde as represented the total fleet of a second-rate naval power. Since the Dreadnought era began the Clyde has completed the following battleships and battle cruisers—a list which roughly constitutes one-fourth of the total number of capital ships under the command of Admiral Jellicoe—the Colossus and Ajax at Greenock; Conqueror and Benbow at Dalmuir; Inflexible, Australia, and Tiger at Clydebank; and the Indomitable and New Zealand at Fairfield. There are certain other ships, about whose construction nothing may be said, however.

A Self-Contained Area

But it is in the multiplicity of its establishments that the Clyde leads the world. A battleship may be produced and equipped in every detail, everything being manufactured locally. There are immense gun shops, gun mounting departments, armor-plate shops, shell factories ad lib., a torpedo factory, and torpedo-testing range. The explosive works in our midst are the largest in the world. Then there is the highly technical establishment which produces range finders for guns. Every Navy extant has received some of Glasgow's products in this department—the British of course securing the specialties exclusively. Not even organized Germany can show a single centre with such multiplicity of warlike productivity.

The honor of leading the Clyde in this gigantic development of becoming the greatest naval and military arsenal in the world belongs to the firm of Wm. Beardmore & Co. It is very well known that the Parkhead establishment produces all kinds of weapons up to the largest naval guns in use on his Majesty's ships. Included amongst these are weapons for sisters of the Queen Elizabeth, completing "somewhere" in this country. The firm began its gun department ten years ago, on the personal initiative of its present head, Sir Wm. Beardmore, whose enterprise in this and other directions has proved a lucky asset for the nation to-day. Prior to the guns the Parkhead works had acquired great repu-

tation for their armor-plate. This involves the most complex metallurgical problem undertaken by steel manufacturers; and here, be it said, the product of Messrs. Beardmore stands unrivalled throughout the world. It is not generally known that until recently nearly all the English firms which produced armor-plate did so on a process invented and patented by Krupps, of Essen, to whom a royalty of 10s per ton was paid for license to work it. Messrs Beardmore never used this process. They adhered to their own methods, and by costly experimentation evolved a plate which is superior to the Krupp.

Universal Providers

During the Russo-Japanese war it was an odd coincidence that vessels engaged on both sides had materials in their hulls or engines which had come from Parkhead. The Russian battleship Petropavlovsk, which was sunk by a mine outside Port Arthur, had materials—engine, shafting, etc.—which were manufactured at Parkhead; while the Japanese battleship, to name one only, the Shikishia, had plates which were produced in Glasgow.

Messrs. John Brown & Co., Clydebank, come next to Messrs. Beardmore in the importance of their products for war. They built the Japanese battleship Asahi, which formed part of the squadron under Admiral Togo in the Sea of Tsushima when the Russian fleet was completely annihilated. Several years ago when on a visit to Glasgow, the Japanese naval commander paid a special tribute to the fine work of the Asahi in the greatest naval battle since Trafalgar. Messrs. Brown & Co., have at present the superintendence in Russia of one of the Government yards, where our Ally's new fleet is being prepared. One of their great successes has been achieved in turbine engine construction, developing the American Curtis system, and they have been favored with many Admiralty vessels designed for fast steaming. The Tiger battle-cruiser, the fastest in the world, came from this yard soon after war broke out.

In order to compete successfully with the great armaments firms of Vickers & Company at Barrow, and Wm. Beardmore on the Clyde, Messrs. John Brown & Co., combined with the Fairfield Company and the Coventry Ordnance Company, laid down a splendid factory at Scotstoun some years ago for the purpose of completing gun mountings. Messrs. Beardmore's is the only establishment on the Clyde which can completely build and equip a warship, while Messrs. John Brown & Co., and the Fairfield yard come next—a considerable distance behind, it must be admitted—in the multiplicity of their products and capacity to build and equip a battleship.

"BARGING ABOUT THE NORTH SEA"

WHEN Rear-Admiral Sir David Beatty, on a recent occasion spoke of the British Navy as "barging about the North Sea" (says the "Scotsman"), all who heard him realized the measure of the Navy's regret that there had been so much difference between what it wished to do and what it had been given an opportunity of doing. To sweep the seas of the world clean of the surface craft of the enemy within a few months, to impose upon his commerce a strangle hold, to fight land batteries and cover the operations of troops on distant coasts, to smash a way up tropical rivers, and edge over the shoals of a flat coast-line with great guns working mightily for the sake of a stricken people—these have been great achievements, but they have not satisfied the fleet. "The sure shield of Britain" has not failed her, and the utmost ingenuity of an absolutely unscrupulous enemy has been countered successfully and in silence. The whole world was made aware of the awful things which the German submarines would achieve, and now the whole world is aware that they have achieved practically nothing, and is almost imploring Britain to tell what she did to them. Such is the difference in method. The resounding phrases of the commission to the submarines of the enemy to "cleanse the North Sea" produced no evidence of disturbance over here. His underwater craft put out with injunctions of frightfulness showering upon them, and with impressed neutrals awaiting results, but they were just quietly gathered in, and the manner of their ending was a mystery to the Fatherland.

Opportunity Lacking

There has been lacking, however, the one great opportunity, as compared with which all the achievements indicated are regarded by the British Navy as of little moment. The enemy's fleet has remained locked away behind the minefields, and there has been no smashing contest such as would recall the famous days when the navies of nations fought. Deprived of the great test—the test which it believes would be final—the British Navy is disposed to look upon all else that it has done as mere "barging about."

It has been seen that "barging about" has included the reduction practically to impotence of the submarine service which the enemy had regarded as his most valuable sea weapon. It has included much more than that. If it were possible, indeed, to tell at this time all that "barging about" has meant, the gratitude and pride with which the nation—and not alone this nation—regards the Silent Service would be deeper than ever. The earliest days of the war were stirring days at sea. They seem far off now, and the lessons they provided have been well learned. Our Fleet at that time had yet to measure the infamy of the enemy, and to realize that to the German nothing was sacred but his success. There were some fine feats of seamanship during the first black, wild winter round coasts darkened and disguised, and amid courses mazed and mixed and falsified in "the blindfold game of war." Be it remembered that many of the ships of the Navy had been drawn across the world to the work on the lightless, shallow, narrow sea, where the enemy was assured that his mosquito craft from the harbors behind Heligoland would hunt at will. Sailormen will appreciate the seamanship which kept the ships in safety at their work, day and night, on such coasts, under such conditions. Efficiency and accuracy in the engine-room; efficiency, accuracy, and our heritage of "sea sense" on the bridge; these were the factors which, in darkness and storm, upset all the calculations of the enemy, and nullified all his efforts. The nerve of the Fleet was better, and the Fleet itself stronger, at the end of the winter than it had been at the beginning. The German calculation was that its nerve should have been gone, and the best of its ships destroyed. The strain only proved the quality of the Navy.

A "Tramp" Incident

There were many comparatively unimportant incidents of almost a year ago which at the time sent a grin round the fleet and did their part in the general hardening. These were connected, for the most part, with the attemepts of the enemy to maintain supplies for his submarines. Many of our tars will recall one such incident which involved quite a feat of seamanship. It occurred out on the North Sea, and possibly a little west of the long Forties. Just about twelve months have gone since the affair, but it still raises a smile in certain quarters. A fast, light cruiser of our Navy on a very dull morning, after a calm, cold night, sighted a cargo vessel under a neutral flag, and came to regard her with some suspicion. The "tramp" was kept under observation for a long time before she received any evidence at all of being watched. To outside appearance, the neutral was in that condition which brings to his mouth the heart of a skipper expectant of salvage, and no doubt more than one trawler that morning had glanced at her hopefully, and again and again, for a signal that she had broken down and wanted a tow.

Lying off in the distance, the warship was satisfied that the tramp was not "going lame," but was waiting for something. Having arrived at that con-

clusion, the neutral was approached in the usual way, and an examination was made. In the making of the examination the "gullible and unsuspecting" Britisher rather scored. The officer entrusted with that duty did not spend much time over it. That was not necessary. He was apparently satisfied as to the bona fides of the tramp when he shouted a cheery "Good-bye," and returned to his ship. His report was to the point. Whilst "looking at nothing" he had seen enough to be certain that the vessel was neither a neutral nor an innocent tramp steamer with a defect in the engine-room. The warship disappeared, and the tramp "limped" along, with no more than steerage-way on, as before. Throughout eleven weary hours patient eyes and ready guns were turned on that unsuspecting merchantman, and at length darkness fell. Then there was vouchsafed the watchers that for which they had waited so long—the combination of lights on the neutral. It was a clever combination, in which her ordinary lights played the part of permanent basis. Having learned all that she seemed likely to learn by waiting, and being now certain that anything that was about to happen to the cargo steamer would not be seen by any submarines that might be about, the warship made a move in the darkness. During the whole eleven hours the position of the suspect had hardly changed. The extra lights of the combination suddenly vanished on the tramp as the cruiser bore nearer, and that was the first indication to the invisible fighting ship that the crew of the tramp had heard the rumble of machinery somewhere and were taking precautions. Then an astounding thing happened. On the quarter of the tramp a section of the darkness materialized in the most startling fashion, and from it there poured over the merchant ship a crowd of sturdy fellows who dashed for the bridge and dived for the engine room and had the ship in their hands and her crew prisoners within five minutes. The cruiser, slipping up in the blackness had laid her long, slim bows alongside as sweetly as ever she laid them along a jetty, and the boarding party asembled forward did the rest. The crew of the tramp had no time to do anything in the way of warning anyone. It was smart work, and a valuable capture. Stores of food, drums of oil fuel, and spare torpedoes were carried under the sham cargo of the supply ship. She was steamed into port by her prize crew, and she steamed very well indeed. It is said that she steamed out of port again not long after, and that on resuming her interrupted duties with a new crew she exercised a distinctly demoralizing influence upon certain units of the submarine service of the enemy.

Beatty's "Boarding"

The feat at seamanship involved in laying the cruiser alongside her quarry so suddenly and so closely in the darkness was noteworthy, but on the occasion of the fight at racing speed between our battle cruisers and those of the enemy, off the Dogger Bank, last January, there was provided a no less notable example of the splendid skill with which the fighting ships are controlled. It will be remembered that when the Lion dropped out of action, Admiral Beatty transferred his flag to the Princess Royal. The Princess Royal, steaming at full power, was using her guns with effect upon the fleeing enemy, without intermission. To recall her from that work in order that the Admiral might get on board was apparently not thought of. She had to be overtaken, not recalled. To catch her the Admiral boarded the Attack. The destroyer was asked to overtake a battle cruiser which was running at well over 30 miles per hour and to put the Admiral on board without delay. The Attack was "opened out" to the task, and it may be questioned if even her designers dreamt of the speed she developed. The Princess Royal was overhauled, but kept on her furious way, her guns crashing out unceasingly. Steadily the Attack worked closer, and very soon, with engine-room responding with marvellous precision to the demands of the bridge, she was reduced in speed to enable her absolutely to cling to the speeding leviathan ahead of her, and with both vessels rushing along at that terrific pace the Admiral passed from the destroyer to the battle cruiser and resumed his place in the action.

TORPEDO-PROOF FLEET

E. ASHMEAD-BARTLETT, the representative of the London newspapers at the Dardanelles, in a recent despatch describes the arrival of our fleet of monitors in the Eastern Mediterranean and the sensation which they caused. The first arrived, he tells us, one fine day in July. She was unlike any other vessel ever seen in these parts, having a low freeboard, almost flush with the water, a 9.2 in her bows and a long 6 in. astern. She was followed by another little bird of passage, even smaller, armed with two brand new beautiful 6-in. guns, "the same as the Lizzie's," as the crew delight to tell you.

A Mysterious Wobbler

The next arrival caused somewhat of a sensation, not only to the enemy, but to our own troops. One afternoon there appeared at the entrance of Kephalos Harbor an amazing-looking object. She could hardly be said to steam up, but rather wobbled into port, like a huge goose primed for Michaelmas. It was impossible to tell at a distance whether she was broadside on or showing her bows or her stern, for she seemed to be quite round. Her high sides held aloft an absolutely flat deck, on which nothing showed except an enormous turret, from which projected two guns of enormous girth and length, whilst rising up from her centre, like a giant of some Californian forest, was a huge striped tripod, bearing aloft a kind of oblong jewel box, the exact replica, on a huge scale, of that in which the Dalai Lama bears about with him the ashes of his first embodiment. With great difficulty, steering vilely, she made her way through the crowded harbor and dropped her anchor with the eyes of thousands riveted on her. No one had ever seen the like of her before.

Walking on the Water!

Sensation followed sensation. Her crew began to bathe. Apparently all possessed the divine power of walking on the water, for, on descending the ladder, instead of plunging into the waves, they walked along them by the side of her, and, having thus distributed themselves, proceeded to dive in, only to climb out again a few minutes later at their will.

We set off in boats to investigate this strange phenomenon, and then found that just below the surface her sides bulge out some 10 ft. and then curve under, forming a platform just washed by the waves. This is the secret and the mystery of these craft. In that bulge man has concentrated his ingenuity to defeat the submarine. If a torpedo strikes her side it will explode amidst a variety of substances which I must not mention, and the hull of the vessel will escape injury. These huge monitors carry naught but two 14-in. guns and some anti-craft armament.

Later on three more of these monitors arrived, giving us eight 14 in. with which to bombard the enemy's positions, in addition to a large number of smaller monitors of all shapes and sizes, some with names and some without, but each armed with the very latest weapons of precision.

Then the new fleet began to settle to its work, sallying forth day by day and bombarding the enemy's positions, being spotted for by balloon ships and aeroplanes. The Turks and the Huns then began to grasp the sad fact that we had once more regained command of the surface of the seas, and that the great effort which had led to the retirement of our high seas fleet had been wasted after all. Later on two other strange vessels, the Endymion and Theseus cruisers, 25 years old, also protected by a formidable waistbelt, similar to that worn by the monitors, turned up.

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LAKE SHIPPING PROSPECTS

THE general industrial situation still shows an improving tendency. While the bulk of the business is largely due to the filling of contracts for munitions and war supplies, considerable activity is being shown in other spheres of industrial enterprise. The successful harvesting of an unprecedented crop will go a long way to stimulate trade conditions in Canada, the transportation being expected to tax to the limit existing facilities and equipment, both on land and water.

Some idea of what the great Western crop means to our steamship lines may be gathered from the fact that this year there is a crop of wheat in the West amounting to 325,000,000 bushels. Of this, it is said, 100,000,000 will be required for home consumption, etc., while 225,000,000 will be available for export. Last year only 35,000,000 was exported from the West.

It is said that it will be a physical impossibility to move more than 100,000.000 bushels east of Fort William before navigation is resumed in the spring so that vessel owners will start next year's business with 100,000,000 at the head of the lakes ready to be moved. At the commencement of 1915 there were only between 5 and 10 million bushels at the head of the lakes.

Finally, it is to be remembered that most of our inland shipping makes for the head of the lakes at the close of navigation to receive a storage cargo for the winter. The earnings from this source will, of course, be clear gain over the earnings of last year when there was no surplus of wheat at the head of the lakes to store in this manner.

ANTICIPATING RESUMPTION OF PEACE-TIME BUSINESS

IT is generally conceded, and at first sight reasonably so, that, after the necessarily long period of neglect, much constructional leeway will have to be made up. The expectation then is that a burst of prosperity such as we have probably never known, will so efface the transition from war to peace that neither stock prices nor productive activities will be affected.

A boom is predicted in merchant shipbuilding to make good the losses by sinking, and to compensate for the almost total extinction of vessel construction in Britain. A similar boom is predicted in the sphere of railroad betterment, to compensate again for the long period during which maintenance has been neglected and earnings conserved. Development work of every description, private, municipal and Governmental, is, we are told, to be no exception; thus, on paper, the end of the war seems to be desirable for a variety of reasons.

In all calculations or prophesies of the nature of the foregoing, no cognizance, however, is taken of the price we are having and will have to pay for the war. We forget that in addition to war stocks reaching giddy heights, material and labor, and all else have pyramided. Stock market prices have a knack of crashing down en masse when the opportune moment arrives; not so these others.

With the end of the war in sight, attention will, as already indicated, be turned to the peace-time pursuits of shipbuilding, railroading, etc. It will be found, however, that shipowners, railroad executives, etc., continue to sit tight so far as the distribution of orders is concerned, the cost of raw and finished material for the purposes of their requirements being totally prohibitive from the standpoint of the then or immediately prospective earnings. War-time prices for equipment and supplies will match ill with peace-time revenue. A period of readjustment must needs be ushered in, during which business of every description will incline to languish, war stocks will disappear and plain industrials will take their place. Prices of raw and finished material will have to be marked down, however slowly and reluctantly those involved contribute to the process.

MARINE NEWS FROM EVERY SOURCE

Hamonic's Largest Cargo.—The Hamonic arrived at Sarnia recently with 2,750 tons of flour, being the largest load she has carried this season.

The Collingwood Shipbuilding Co., Collingwood, Ont., has been awarded a contract for a large steel freighter, similar in size to the J. G. Hagarty.

Lightkeeper's Residence Burned.—The lighthouse-keeper's residence on Burnt Island, near Gananoque, Ont., together with contents, was totally destroyed by fire on the night of November 5. Mr. Acton, the keeper, and his family lost everything but the clothes they had on.

Thirty-seven Vessels Leave Port.—At daybreak on November 14 thirty-seven grain-laden vessels down-bound from Port Arthur and Fort William, cleared from Thunder Bay harbor. The majority had been lying in shelter during the previous forty-eight hours, owing to the storm which swept Lake Superior during that period.

Halifax, N.S.—Tenders will be received by the Governor of the Province of Macao, up till January 8, 1916, for the supply of a steel, self-propelling dredges for the use of the Macao Harbor Works. Full particulars may be obtained at the office of Fred. H. Oxley, Consul for Portugal, Keith Bldg., Halifax, N.S.

St. Johns, Nfld.—The steamships "Adventure" and "Bellaventure" have been sold to the Russian government and will be used to keep Russian ports clear of ice in the winter. The "Bellaventure" has recently returned from Hudson Bay. Before leaving for Europe a trial trip will be run with Russian officials on board.

Breakwater Damaged. — A heavy storm on Sunday night, November 1, shifted a hundred feet of the new concrete and stone breakwater at the entrance to Mission River, near Fort William, from a few inches to a couple of feet, and the cost of repairing it will run high. The heavy storm the night following increased the damage by cracking the walls in several places. The work was done last summer.

Winter Season at St. John, N.B.—Preparations have been made at St. John, N.B., to handle, through the coming winter, thre hundred cars of freight a day at the west side wharves, being more than twice what was handled last winter. Twenty-two C.P.R. sailings have been guaranteed from the port, and there will be twenty sailings of supply boats chartered by the Imperial Government.

Windsor, Ont.—President Pressano of the Great Lakes Engineering Works, announces that he has booked contracts for the construction of four additional steel freighters, three for coast service and one for the Great Lakes trade. The steamer for lakes service will be a ship of about 9,000 tons, of 450 feet keel length, and about 56 feet beam. The three coast freighters will be of Welland Canal size.

The Newfoundland Naval Reserve.—The total registration for the Newfoundland Royal Naval Reserve to date is 1,200. Of these, 63 have laid down their lives for the Empire in active service, while others have died through natural causes and more invalided home. The total loss since the war began is approximately 100, so that the present fighting strength of the unit can be estimated at 1,100 men. Of these, 75 are in training on H.M.S. "Calypso" at St. John's, and the remainder on active service in the North Sea doing their duty by King and country.

Trinity, Newfoundland.—It is proposed to make this the winter shipping port of the Anglo-Newfoundland Development Co., whose pulp and paper-making works are situated at Grand Falls. It is highly probable that will be carried to a successful termination, as the commercial people and others of the district have petitioned the Government to have the stub railway leading into the town completed and suitable piers erected. It will mean much, financially and otherwise, to all parties concerned. Mr. Scott, the company's manager, approves of the scheme, viewing it as he does that during the past few years their shipping port in Notre Dame Bay has during winter time been practically closed, inconveniencing as a result their shipment of products. Trinity is an ice free port all year round, besides a town of considerable commercial standing in the district, of which it is the capital.

Three C.P.R. Empresses Released.—The return to normal conditions on the Pacific Ocean is indicated in the official announcement recently issued by the Canadian Pacific Railway Co., which states that its liners Empress of Asia, Empress of Russia, and Empress of Japan, which have been ued by the British Admiralty as cruisers since the war broke out, have been released and are being refitted for regular passenger and freight business at Hong Kong. They will re-enter the commercial service between Vancouver, Japan, China and Manila at an early date.

Smart Repair Job.—Ten days before the time set by the contract the Davie Shipbuilding Company finished the repair work on the Hendon Hall, whose salvage by the Canadian Salvage Co. this summer astonished shipping men, who thought the vessel an irredeemable wreck. It is said that the repairs have cost $95,000, and that at this figure the underwriters have not been able to make any money. It is believed as well that the feat of the salvage company in bringing this abandoned wreck to Montreal netted them very little money. The Hendon Hall is, however, a very welcome addition to the fleet of the West Hartlepool Steam Navigation Co., in view of the difficulty in getting steamers built at the present time or buying except at greatly enhanced prices. It is estimated that the Hendon Hall is now worth about £70,000.

New Range Light.—Completion of alterations to the back range lighthouse at Owen Sound, Georgian Bay, is announced by the Department of Marine and Fisheries. The lighthouse is a square steel skeleton tower, with sloping sides. The tower is surmounted by two galvanized iron lanterns, containing the illuminating apparatus, which consists of a group of 100-watt tungsten electric lamps placed in the foci of paraboloidal reflectors. The light, a fixed white, is shown at an elevation of 92 feet, and is visible fifteen miles in the line of the range. The tower is on the east side of

Sydenham River, Owen Sound, in latitude north 44 degrees 34 minutes 44 seconds, and longitude west 80 degrees 56 minutes 21 seconds. The wooden enclosed upper portion of the former back range lighthouse was destroyed by fire on June 14 this year.

Cunard Leviathans Do Hospital Work.—Cunard Line officials deny the report that the Aquitania and Mauretania have been sunk while acting as transports. "These two vessels," says an official of the line, "have been in the hospital service between Suvla Bay and Liverpool for the last three months. Both ships are painted white and bear Red Cross markings. The Aquitania has been equipped to care for 4,000 patients and the Mauretania for 3,100. The rumor of their sinking may have arisen from the sinking of two transports recently announced by the British Government. One was the Runic and the other the Southland."

Lake Timiskaming Tragedy.—Four lives were lost on Lake Timiskaming on November 11, when in a brisk gale the steamer Aileen, owned by the Nipissing Pontiac Navigation Co. foundered. Nothing was known of the accident until the following morning when the lessee, Mr. Gibbons, called up the wharf at North Timiskaming and found that the boat had not arrived. The Scotsman, another boat of the fleet, put out in search, and in Sutton's Bay picked up some wreckage, and later a gasoline launch located several packages of freight consigned to storekeepers in North Timiskaming. The Aileen left Haileybury wharf about ten o'clock on the morning of the disaster with a small amount of freight aboard, and the last seen of her was when she was in the neighborhood of Chief's Island making good headway.

Steel Range Lights Installed.—After having served their purpose for the past 44 years, the range lights on the Richelieu River at Lacolle have been replaced by lights of a more modern type. The old lights were of wooden construction, but the new ones now installed are made of steel. Capt. J. D. Reid, of the Department of Marine (Montreal District), supervised the work of installing the lights, which have been under operation since the beginning of August. Another improvement is the concrete work which has just been completed on the three piers which will form the upper and lower entrance ranges at Ile aux Sables. When the channel is lighted—which will probably be some time early next spring—it will be used for navigation of craft of the river steamship type as well as tows, having a maximum draft of fifteen feet. This new channel is a continuation of the Repentigny Channel, which was last year lighted up for the use of small river navigating craft.

International Mercantile Marine.—It is understood that the October net earnings of the International Mercantile Marine reached a new high mark for all time of over $9,000,000. This compares with September net of $5,000,000 and August profits of $3,000,000. The average monthly profits of the world's largest steamship undertaking for seven months to August were $3,000,000. Good authorities believe a minimum estimate of net profits of the International Mercantile Marine for the year to Dec. 31, after charging off interest, depreciation and allowing for a 50 per cent. British war tax, is 70 per cent. on the preferred stock.

Tug A. M. Stewart, Launched.—John Cran & Co., Leith, Scotland, launched on October 12, from their Queen's Dockyard, the large and powerful tug, A. M. Stewart, built to the order of the Canadian Stewart Co., Toronto. The principal dimensions of the vessel are: length overall, 110 ft.; length, b.p., 104 ft.; beam, 26 ft.; depth, moulded, 14 ft. Machinery to develop 900 h.p. is being supplied by the builders of the hull. The vessel will be fittted with steam capstan, steam windlass, salvage crane, electric lighting throughout, and a powerful searchlight. Messrs. Cran have two further tugs of equal size and power in progress, and, so far, all the vessels built by them since the war began (four in number) have been taken over by the government.

The Canadian Steamship Lines, it is stated, have 107 boats in active service, 65 freight, of which 16 are on the ocean and 42 passenger. The ocean freighters, the same authority states, earn on the average $10,000 net per month, which for the winter months figures out at nearly $800,000. In addition to this, six vessels of the Quebec Steamship Company, a subsidiary, operate all year. The passenger revenue this year has not been as large as in 1914, but the above figures indicate that ocean traffic alone will wipe out last year's deficit. Freights from the head of the lake average about 4 cents this year against 1¾ in 1914. Operating costs have been cut down by means of various economies to the extent of about $400,000. These are the reasons why September and October earnings alone stood almost half a million dollars ahead of the corresponding months in 1914. It is well known that freight boats had very small storage cargoes at the head of the lakes last winter, but this year the capacity of the fleet of the company will be filled, to the extent of about 2,500,000 bushels, which, it is estimated, will net the company in the neighborhood of $200,000.

Tug "F. C. Barnes" Lost.—The finding of a portion of a pilot house bearing the name Frank C. Barnes on the shore of Lake Ontario, near Oswego, would indicate that the vessel of that name had foundered, with all hands. She left Port Dalhousie on Monday night, November 1, for Sorel. The body of a member of her crew has since been picked up. The tug was in charge of Captain H. W. Larush, who for the past two seasons commanded the steamer Toronto, of the Canada Steamship Lines.

Collier Submarined.—The Norwegian steamer Wacousta, 1,988 tons, is reported sunk by a submarine. The crew was saved. The Wacousta, which sailed from Pictou, N.S., October 19, for Vladivostok, was well known on the St. Lawrence, having for the past seven years plied between Sydney and Pictou and Quebec as a collier for the Dominion Coal Co. She was particularly renowned as an early arrival, mostly every spring being among the very first vessels to reach port after the opening of navigation.

New Line of Boats to France.—The inauguration of a new line of Transatlantic steamers, under the direction of the France and Canada Steamship Co., was announced in Boston, Mass., on November 21. The new service, it is said, would be maintained by ten vessels, including the Carpathia and Ultonia, formerly of the Cunard Line, and others of nearly equal tonnage. Transportation of horses for the allied armies in Europe will be a principal feature of the service this winter after the port of Montreal is closed by ice.

Montreal Harbor Tug Christened.—A further indication of the growing activity of the port of Montreal was emphasized recently by the christening of the new Harbor Commissioners' tug, David Seath, which will bring the number of these boats in use to eleven, whereas five years ago there were only six. All these tugs, with the exception of the Sir Hugh Allan, have been constructed in the Harbor Commissioners' own shipbuilding yards at the Mackay (Guard) pier, where several hundred men are kept employed. The David Seath, named after Major Seath, who at the end of this month will have completed his seventeenth year as secretary-treasurer of the Harbor Commission, is 100 feet in length and a particularly sturdy craft. It will be used from now till the end of the season to replace other tugs, and will be put in regular operation next spring.

CANAL'S FREIGHT RECORD

WITH increases in practically all commodities, October, 1915, marked a record-breaking month in the amount of freight tonnage locked through the St. Mary's Falls Canals, according to the statistical report issued by the United States Engineers' Office. The previous record was made in August, 1913, when 11,484,444 tons were carriel through. The total for the past month is 11,587,851, which, compared with October, 1914, is an increase of 3,817,846.

Wheat leads the list of increases, 65,387,356 bushels being carried eastward during the past month, as against 27,678,150 for the corresponding month last year. Some 8,931 more tons of copper and 2,505,282 more tons of iron ore were locked through during October, 1915, than October of last year, the amounts being 22,278 and 6,876,570 tons respectively.

General merchandise also shows a notable increase in both directions, there being 56,466 tons eastward anl 210,758 tons westward. For 1914 the figures totalled 22,177 eastward and 128,047 westbound.

The passenger list again marks a decrease, there being 909 passengers on steamers during the month compared with 1,736 last year.

The number of vessel passages were 3,231. Of the total freight, the American canals carried 9.291,917 tons and the Canadian canal 2,265,934.

MONTREAL DRY DOCK & SHIP REPAIRING CO.

WHEN the steamer Rock Ferry went into dock at the end of Wellington Basin on Mill Street, Montreal, on November 6, to have her rudder repaired, she inaugurated a new era in the work to be done by the Montreal Dry Dock & Ship Repairing Co.

For nearly four years this concern has been doing work at the dock, which before that time was known as the Tate Dry Dock. All this summer work has been proceeding at deepening the dry dock so that its scope could be greatly extended. On Friday, November 5, a group of prominent business and shipping men were shown over the plant to see for themselves that now the dock can take any lake steamer which comes through the Lachine Canal.

The dock has been deepened four feet for 250 feet in length, and a new concrete bottom laid. The Rock Ferry is 260 feet long, and draws 11 feet when light, an indication of the capacity of the new dock. There is a good plant for iron work, completely supplied with air and electric tools. The dock is 50 feet wide and the blocks three feet six inches high. The entire length of the dock is 430 feet.

Among those present were—Thomas Hall, of the Hall Engineering Works, who is managing director of the Montreal Dry Dock & Ship Repairing Co.; F. H. Fox, secretary-treasurer; Captain Johnson, marine superintendent of the Canada Steamship Lines; E. Marceau, chief engineer Quebec Canals; D. O'Brien, superintendent Lachine Canal; Captain Archibald Reid, port warden; Captain J. N. Bales, assistant port warden; L. L. Henderson, manager and director Montreal Transportation Co.; F. W. Cowie, chief engineer Harbor Commission; A. Kastella, chief engineer Department of Public Works; George Hadrill, secretary, Montreal Board of Trade; Captain J. O. Grey, Frank Wright, and Ralph Hall, the last three from the Hall Engineering Works.

AMERICAN PORTS GETTING OUR GRAIN

CANADA'S wheat crop is being rapidly moved to market. The railroad earnings indicate this emphatically. But, despite the volume of grain and the immense supplies pressing forward from the prairies, the water-borne arrivals at the port of Montreal during the month of October were 4,000,000 bushels less than the same month a year ago, the figures being 6,432,245 bushels against 10,574,568 bushels. There is one answer. The lake traffic is flowing to Buffalo and American ocean outlets. A prominent shipping authority makes the statement that eighty per cent. of the Western Canadian wheat moving this autumn will go by the latter routes.

For this condition of affairs there are a number of reasons, but the situation may be summed up in the observation that the grain is not coming to Montreal because ocean transportation facilities are lacking; it is following the line of least resistance in seeking outlets. That the current of the movement has been changed may be largely put down to the abnormal transportation conditions prevailing—particularly on the Atlantic.

That Montreal is not at present a favored port for ocean craft has two explanations voiced by shipping men. In the first place, a British vessel in a British port may be liable to seizure at any time by the British authorities for military purposes; this would not be likely to happen in a neutral port. Then the fact that ocean freight rates on grain are about eight times what they were in 1914 before the war naturally reduces the attraction of the northern passage. These rates adjust themselves as between different ports, but the fact remains that the present tariffs make the southern haul the more attractive. The danger from delays by fog in the Straits is avoided, as well as the slower river trip, which necessitates pilotage, etc.

The Lake Rates

The direct factor in the situation so far as the lake carriers are concerned is seen in the higher rates being offered from Georgian Bay to Buffalo as compared with Montreal. There is as much as half a cent in favor of the cargoes to American ports, which indicates the situation pretty clearly. If there were not an advantage in favor of the Buffalo route it may be taken for granted that much more of the grain would be finding an outlet at Montreal. There has been no particular congestion at the Canadian port on account of shortage of lake bottoms for the reason that the grain is not being taken where there are not facilities for Atlantic service.

At the same time, it should be pointed out again, on the authority of officials of the Canada Steamships Company, that the lack of grain shipments through Montreal is not due to any shortage of Canadian lake boats. It is stated that the Canadian tonnage could give Montreal all that the facilities could handle without calling in American freighters. Naturally on the face of such a situation the conclusion is liable to be drawn that the lack of grain shipments through Montreal is due to a shortage of Canadian carriers, and such a conclusion might be used as a lever in favor of the suspension of the coastwise lake traffic rules. But it is not a business probability that American boats could be got to run into Montreal when there are better rates to American ports.

The Lake Earnings

Lake carriers are getting somewhat higher rates than a year ago, but the increase is trifling compared with the advances which have been made in the Atlantic service. In this connection Canadian ship-owners point out that they feel that they are entitled to good business at this season, as the summer was very poor in the grain business. Steamers have actually made the trip from the head of the lakes "light," not being able to pick up a cargo.

Subsidize St. Lawrence Route

Speaking of the larger question of the completion between the Canadian and the American grain routes, a prominent shipping man has expressed the opinion that there are not wanting signs that the Canadian Government will have to consider the subsidizing of the St. Lawrence route if we are to hold our own in the grain trade. The problem is based upon the cost of transportation from the head of the lakes to Liverpool, and whether the Montreal route or that of Buffalo and New York is favored will depend upon the advantage in price.

ASSOCIATION AND PERSONAL

A Monthly Record of Current Association News and of Individuals Who Have Been More or Less Prominent in Marine Circles

A. A. Larocque has been appointed vice-president of the Sincenes-McNaughton Line, Ltd., Montreal, in succession to the late Major A. V. Roy, who met his death recently while fighting with the Canadian forces in France. Mr. Y. Dupre was elected to fill the vacancy on the directorate.

Thomas Lynch, aged sixty years, of Port Dalhousie, pilot on the Welland Canal, was instantly killed on November 7, when attempting to board the steamer Knoba in Lock 7. He had climbed to the deck rail on a rope, but lost his grip in endeavoring to pull himself over and fell between the steamer and the stone wall of the lock just as the boat swerved with the rush of water from the lock valves.

Penrose J. Clemens, city salesman of the Canadian H. W. Johns-Manville Co., Toronto, died in that city on November 6, aged 44. The deceased was born in Prescott, Ont., and was for some years superintendent of the Galt, Preston and Berlin Railway. Mr. Clemens was a brother-in-law of D. M. Medcalf, chief boiler inspector, Province of Ontario

Jerome Newman, chief engineer of the San Francisco Harbor Commission, believes that the only two North American ports being operated entirely under Government rather than municipal authority, Montreal and San Francisco, have amply demonstrated by their success that a commission deriving its authority in this manner gives a port the best kind of administration it can have. He was recently in Montreal after visiting Los Angeles, New Orleans, Baltimore, New York, Philadelphia, Boston and other ports, and expressed himself as amazed at the development accomplished by the Montreal Commissioners. Mr. Newman spent some time in studying the elevator arrangements in the harbor, but was occupied mainly with the engineering side of the port development under the tutelage of F. W. Cowie, chief engineer of the Montreal Harbor Commission.

D. M. Medcalf, chief inspector of steam boilers for the Province of Ontario, has returned to Toronto after a visit to the coast extending over a period of six weeks. Mr. Medcalf visited the chief boiler inspectors for each of the Western provinces and was successful in concluding an arrangement whereby boilers destined for British Columbia, being built in Ontario, may be inspected by Ontario boiler inspectors. Mr. Medcalf's itinerary included a visit to the Panama-Pacific Exposition at San Francisco, Cal.

John Adams, who had charge of the wharf office of the Shipping Federation in Montreal, and was a familiar figure along the waterfront there, died at his home on October 28. In his sixty odd years he had had a wide and varied sea experience before coming to Montreal more than a decade ago. He had been employed mainly with the States Steamship Co., and the Orient Steam Navigation Co.

Hon. E. L. Patenaude, Minister of Inland Revenue, was the guest of the Montreal Harbor Commissioners for a tour of the port, on board the tug Sir Hugh Allan, recently, lunch being served on board. Among those who took the trip were W. G. Ross, chairman of the Harbor Board; Sir Rodolphe Forget, Lieut.-Col. A. E. Labelle, Farquhar Robertson, Captain Bourassa, Major Seath, A. Grenier and Charles Robillard.

Presentation.—On Wednesday, Oct. 27, on the occasion of the 1000th number of "Syren and Shipping," London, England, a presentation was made to Joseph L. Carozzi, editor and managing director, by the staff. It was purely "a family affair" (not in the D'Artagnan sense), and representatives from Rotterdam, Glasgow, Newcastle and Liverpool were present to testify their affectionate allegiance to "the chief." The presentation, made in the afternoon at the of-

LICENSED PILOTS.

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Captain Walter Collins, 43 Main Street, Kingston, Ont.; Captain M. McDonald, River Hotel, Kingston, Ont.; Captain Charles J. Martin, 13 Balaclava Street, Kingston, Ont.; Captain T. J. Murphy, 11 William Street, Kingston, Ont.

ST. LAWRENCE RIVER, BAY OF QUINTE, AND MURRAY CANAL.

Captain James Murray, 106 Clergy Street, Kingston, Ont.; Capt. James H. Martin, 259 Johnston Street, Kingston, Ont.; John Corkery, 17 Rideau Street, Kingston, Ont.; Captain Daniel H. Mills, 272 University Avenue, Kingston, Ont.

ASSOCIATIONS

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James Gillie and A. E. Kennedy, Kingston, Ont., Grand Auditors.

1915 Directory of Subordinate Councils, National Association of Marine Engineers.

Name.	No.	President.	Address.	Secretary.	Address.
Toronto,	1	Chas. M. Arnott,	94 Hanley Street	J. S. Adams,	1 Gladstone Ave.
St. John,	2	G. J. McVicar,	49 Winslow St. West	G. T. G. Blewett,	36 Murray St.
Collingwood,	3	Wm. Whipps,	Collingwood, Ont.	Robert McQuade,	Collingwood, Ont.
Kingston,	4	L. E. Spencer,	24 Clergy St.	James Gillie,	101 Clergy St.
Montreal,	5	Henry Lamereaux,	280 St. Andre St.	O. L. Marchand.	[illegible] Clark St.
Victoria,	6	John E. Jeffcott,	Esquimault, B.C.	Peter Gordon,	808 Blanchard St.
Vancouver,	7	W. G. Wooster,	Room 10, Jones Bldg.	E. Read,	Room 10-12, Jones Bldg.
Levis,	8	Michael Latulippe,	Lauzon, Levis, Que.	S. G. Guenard	Bienville, Levis, Que.
Sorel,	9	Nap. Blandon,	Sorel, Que.	Alf. Charbonneau,	Box 204, Sorel, Que.
Owen Sound,	10	John McLeod,	570 4th Ave.	J. Nicoll,	714 4th Ave. East
Windsor,	11	Alex. McDonald,	28 Crawford Ave.	Neil Maitland,	121 London St., W.
Midland,	12	Geo. E. Wilson,	P.O. Box 204	Roy N. Smith,	Box 178
Halifax,	13	Robt. Blair,	29 Preston St.	Chas. E. Pearce,	Portland St., Dartmouth, N.S.
Sault Ste. Marie,	14	Charles H. Innes,	27 Euclid Rd.	Geo. S. Biggar,	43 Grosvenor Ave.
Charlottetown,	15	Philip Bridges,	Stewart St.	Chas. Cumming,	27 Easton St.
Twin City,	16	H. W. Cross,	36 Ambrose St	E. L. Williams	142 Secord St., Port Arthur, Ont.

fice, took the form of a gold watch, suitably inscribed, and bearing testimony, not only to his undoubted ability, but primarily to the recognition by the staff of his uniform kindliness, courtesy and attitude of appreciation towards them for work done. The event was perpetuated in the evening by a presentation dinner at the Criterion.

Advanced Weather Forecasts.—Under an arrangement endorsed by President Wm. Livingstone, of the Lake Carriers' Association and approved by the Government, N. B. Conger, observer in charge of the Detroit office of the Weather Bureau, began November 22 sending out daily forecasts of weather conditions on the upper lakes three or four days in advance, giving special attention to prospective dropping temperature as well as general weather conditions. The service will continue until navigation closes. The forecasts will be posted daily on lake carrier bulletins.

S.S. "Dunelm" Missing.—The Dunelm, which left Sydney on Saturday, October 16, with a full cargo of steel products for Manchester, England, has not yet reported, and it is feared that she has met with disaster, either being sunk by a German submarine or has foundered at sea. Although there have been no reports published in England of vessels lately sunk by submarines in English waters, there is plenty of room for supposition that the Dunelm was torpedoed, for the usual trip only takes about fifteen days. She had a gross tonnage of 2,319 tons, and carried a crew of 25 men. The Dunelm is owned by the Canadian Steamship Lines, Montreal, and was under charter to the Dominion Iron & Steel Co.

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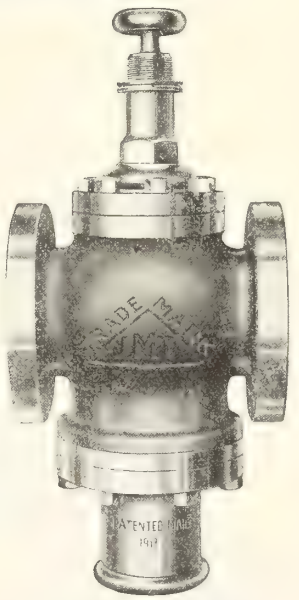

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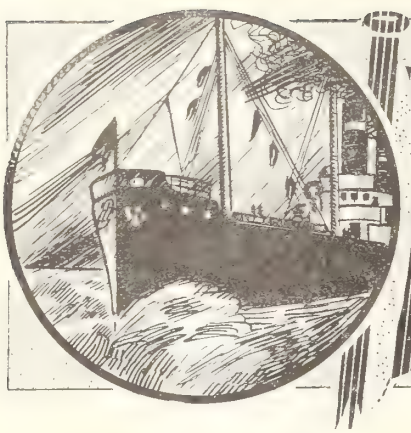

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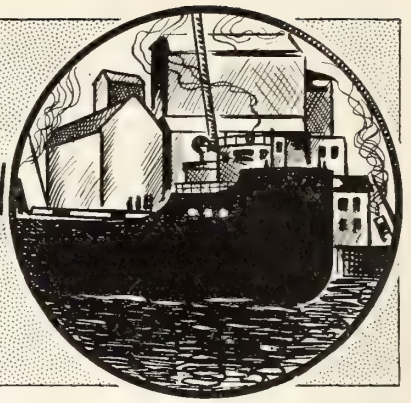

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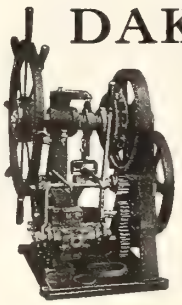

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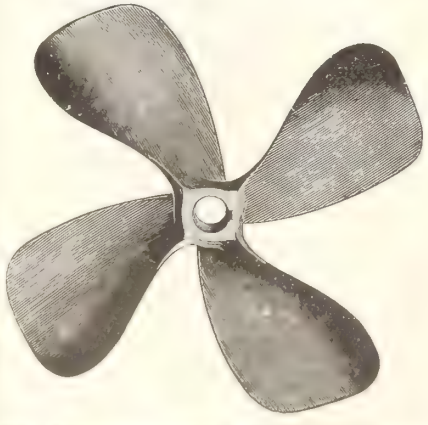

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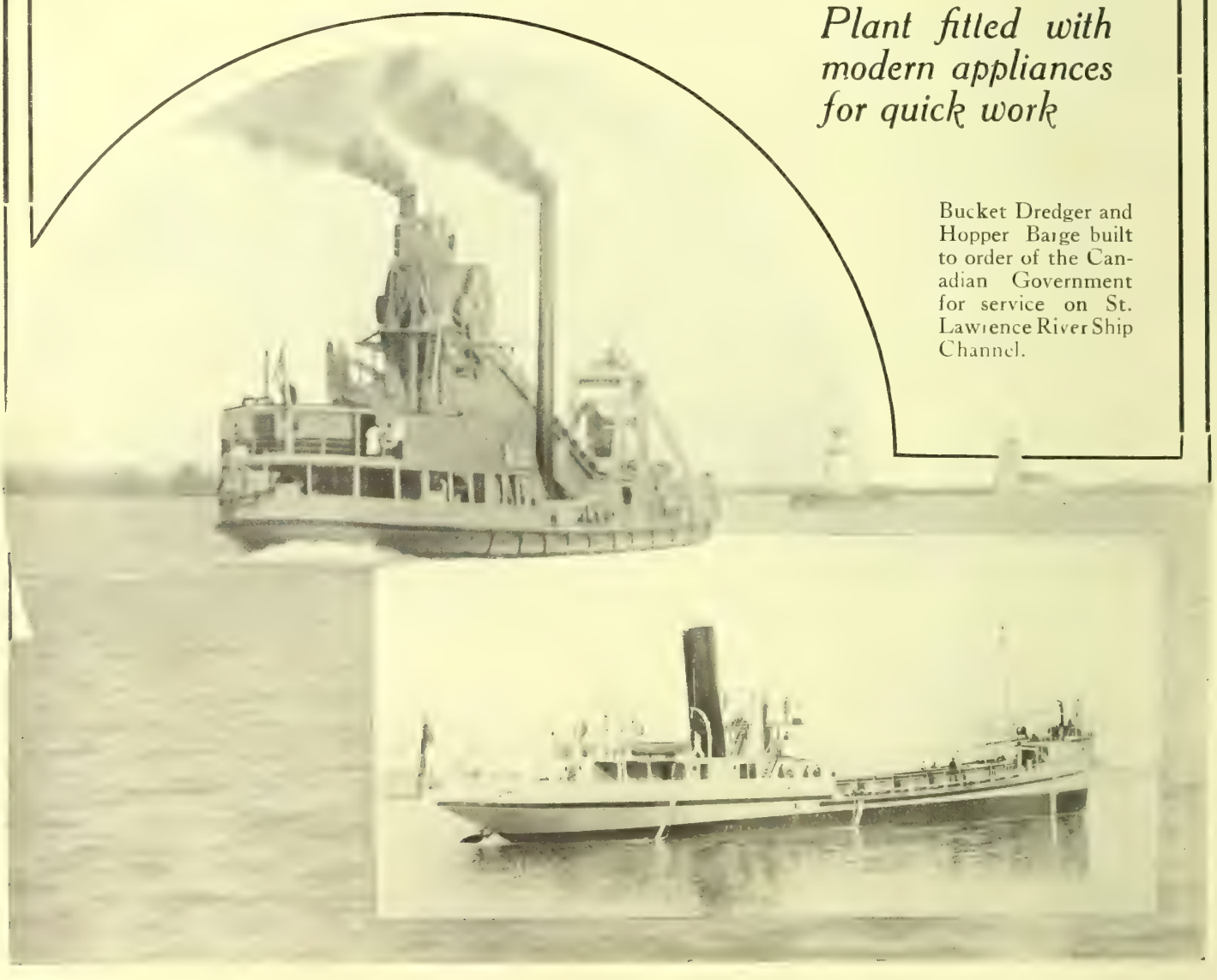

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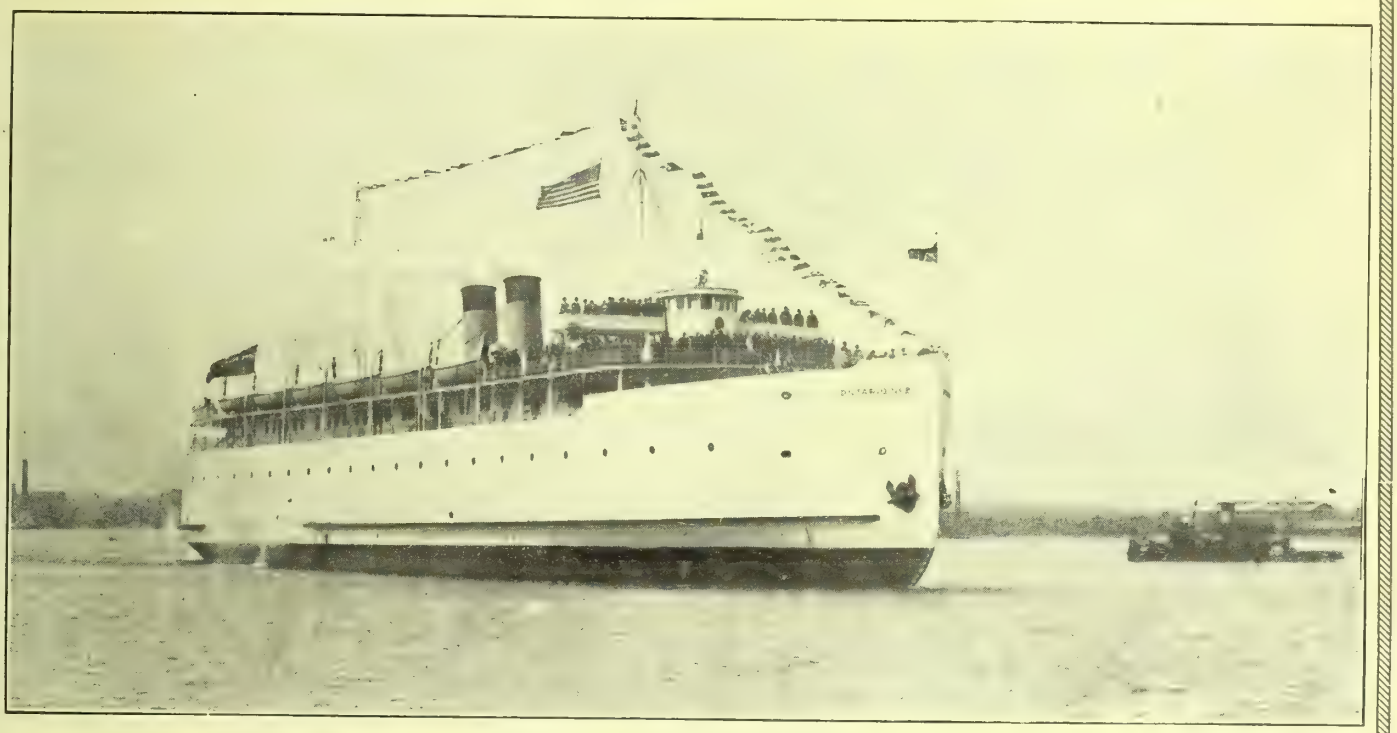

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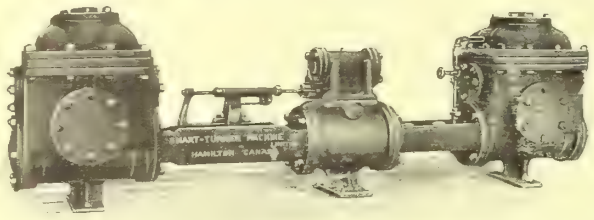

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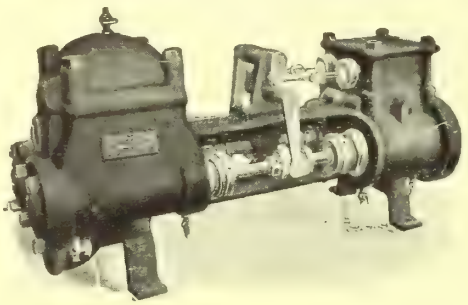

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"Watch the Thermometer"

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The Publisher's Page

By B.G.N.

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Canadian Government Railway Ferry Steamer, "Scotia II."

In our May issue of this year, a brief account was given of the launch of "Scotia II," which took place on the 13th of the month previous. The christening ceremony was performed by Lady Drummond, of Montreal. Through the courtesy of "Engineering," we are now enabled to not only give a very complete detail of the vessel and her equipment, but to enhance same with appropriate illustrations. A picture of "Scotia I" is also shown.

THE railway ferry steamer Scotia II. was built by Sir W. G. Armstrong, Whitworth & Co., at their Walker Yard, on the Tyne, England, to the order of the Dominion Minister of Railways and Canals, for service in connection with the Intercolonial Railway System. The vessel embodies many interesting features in design, construction and equipment, and will ply across the Straight of Canso, between the mainland of Nova Scotia and Cape Breton. There being considerable inflow in the Strait during the winter season, the constructional details and hull form of the Scotia II. are such as to keep the ice broken, and thereby maintain an open passageway for the railway service.

Thhe vessel left the Tyne on August 31 last, under the command of Captain Manning, and, in spite of heavy weather on the voyage, arrived at Port Mulgrave on September 15, proving the structural strength of the hull, and the fact that vessels of this character can safely cross the Atlantic. Her principal dimensions are as follows:—

Vessel length over all, 300 ft.

Length between perpendiculars, 286 ft. 6 in.

Breadth, extreme, over fenders, 50 ft.

Depth, moulded, 20 ft.

Draught of water, 14 ft. 2 in.

Displacement at 14 ft. 2 in. draught, 3,665 tons.

The Scotia II. is of the single deck type, and conforms to the highest classification of both Lloyd's and the Board of Trade. In order to support the weight of heavy locomotives on the centre track, increased strength has been introduced into the deck framing. The three lines of track are laid to 4 ft. 8½ in. gauge, and the cars will be shipped and discharged over the forward end only. The four coal bunkers with which the vessel is fitted are arranged so that they can be loaded from cars on the railroad tracks over the boilers.

The longitudinal elevation, Fig. 2, shows the ram form introduced in order to break up the ice in front of the forward propeller. The structural arrangement aft is for a single-screw propeller with the ordinary rudder. The hull is specially strengthened at the water-line, fore and aft, and water-ballast tanks are arranged at the forward and after ends. These can quickly be filled in order to increase where necessary the downward thrust for the breaking up of the ice.

To facilitate navigation, a superstructure has been built, which gives clear headway for the railway carriages traversing the track on the deck, and affords a good outlook for navigation purposes. The pilot house on the navigation bridge contains the steam steering gear control standard and the steering compass, also speaking tubes and telegraphs from the house to the engine-room and the steering-gear, which is fitted immediately forward of the rudder. The gear is of

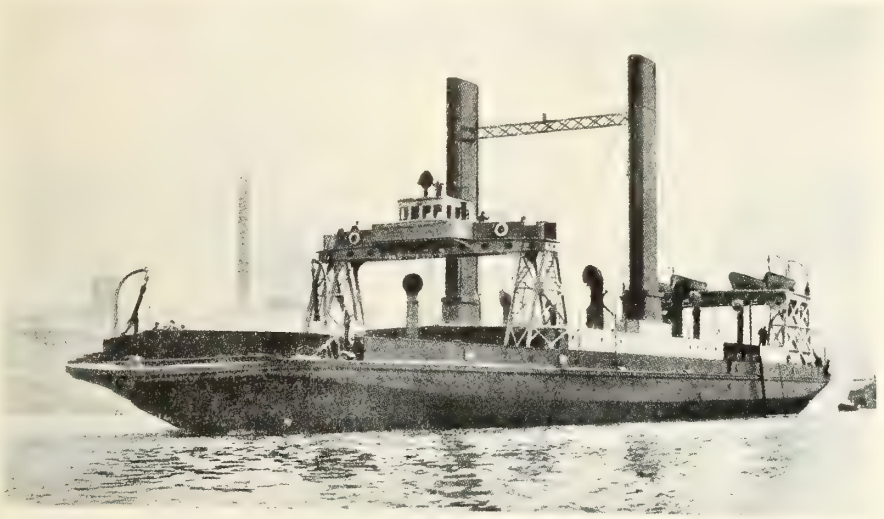

FIG. 1. CANADIAN GOVERNMENT RAILWAY FERRY STEAMER, "SCOTIA II."

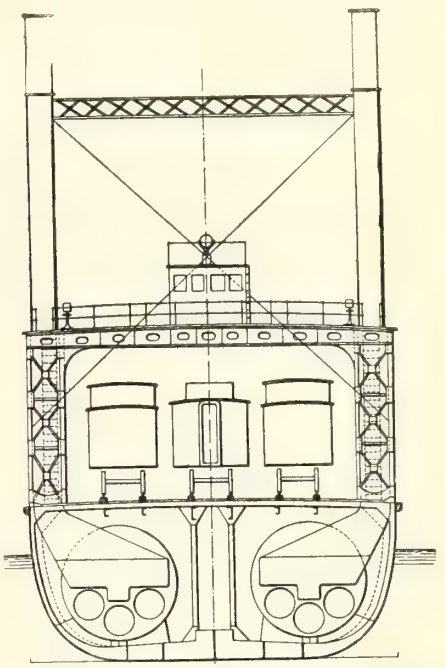

FIG. 3. CROSS SECTION THROUGH BOILER ROOM, ALSO SHOWING BRIDGE AND CAR TRACKS.

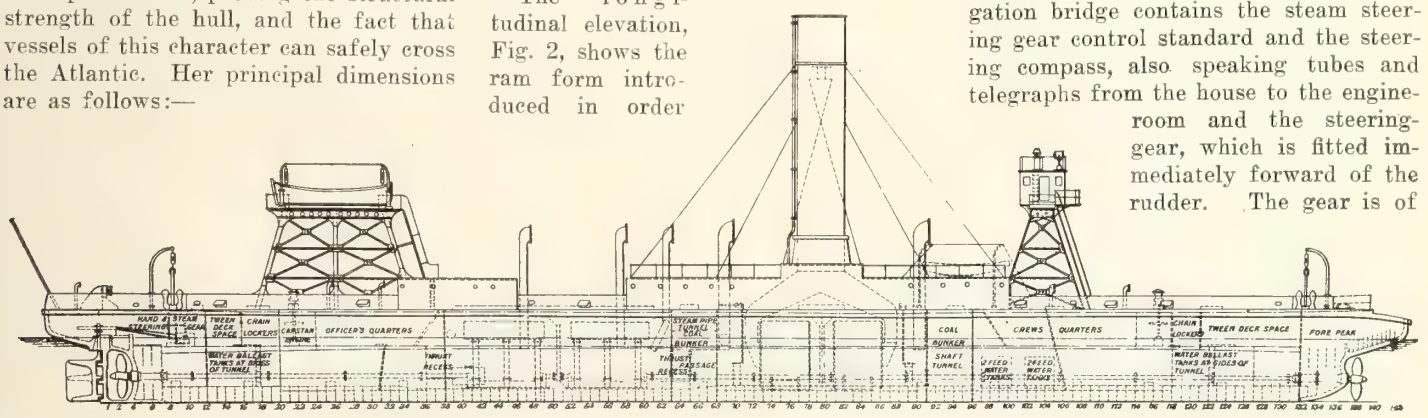

FIG. 2. LONGITUDINAL ELEVATION OF CAR FERRY STEAMER, "SCOTIA II."

the combined hand and steam design.

In addition, there are warping steam capstans placed at each end of the vessel for working anchors, cables, and mooring ropes. The capstan heads are placed on deck, with the engines below the deck. There are also four pairs of mooring bits with the necessary pipes. Aft there is a superstructure corresponding to that for the pilot house, but utilized for carrying four life-boats.

On each side of the upper deck are the funnel casings and also the deck-houses, providing the necessary sanitary accommodation, etc., for the officers, crew and passengers. The nature of the accommodation is clearly shown on the deck plan, Fig. 4. The mess-room and living accommodation for the officers and engineers is under the deck aft, and for the crew below the deck forward, as shown in the plan, Fig. 5. The former accommodation consists of one large mess-room, four rooms for the officers and engineers, one for the steward, two separate rooms for the day and night captains, and two for the chief engineers. The crew's quarters include a mess-room, one room for six seamen, and one for eight firemen.

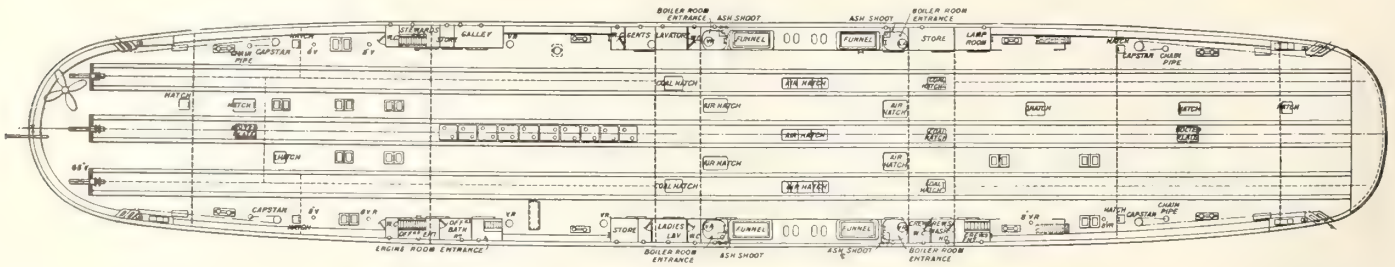

FIG. 4. MAIN DECK PLAN OF CAR FERRY, "SCOTIA II."

A complete installation of electric light is fitted throughout the vessel. The generating machinery consists of two direct-coupled plants, each capable of giving an output of 25 k.w. at 80 volts when running at a speed of 350 revolutions per minute. A searchlight, of 20 in. diameter and 16,000 candle-power, is fitted on top of the pilot house, with the necessary controlling gear and connections therein. There are eight electric fans fitted in the stokehold and engine-room ventilators. An air-compressing plant, consisting of two Westinghouse air-pumps with receivers, is placed in the engine-room. Connections are led to each end of the vessel for providing power for pneumatic tools used for effecting repairs to the hull or machinery.

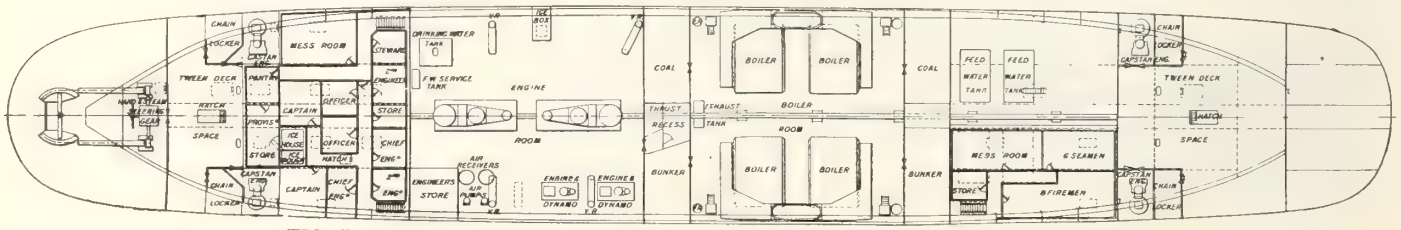

FIG. 5. PLAN SHOWING ACCOMMODATION AND MACHINERY ARRANGEMENT.

Machinery Equipment

The vessel having been designed to act as an ice-breaker while performing her car ferry service during the winter season, the machinery had, of course, to be arranged to suit that purpose. There were therefore fitted two sets of engines on the fore and aft line, the forward engines being arranged to work the bow propeller and the after engines the stern propeller. A suitable coupling was fitted so that the two engines may work either together or independently. The engine-room ventilators are placed in the

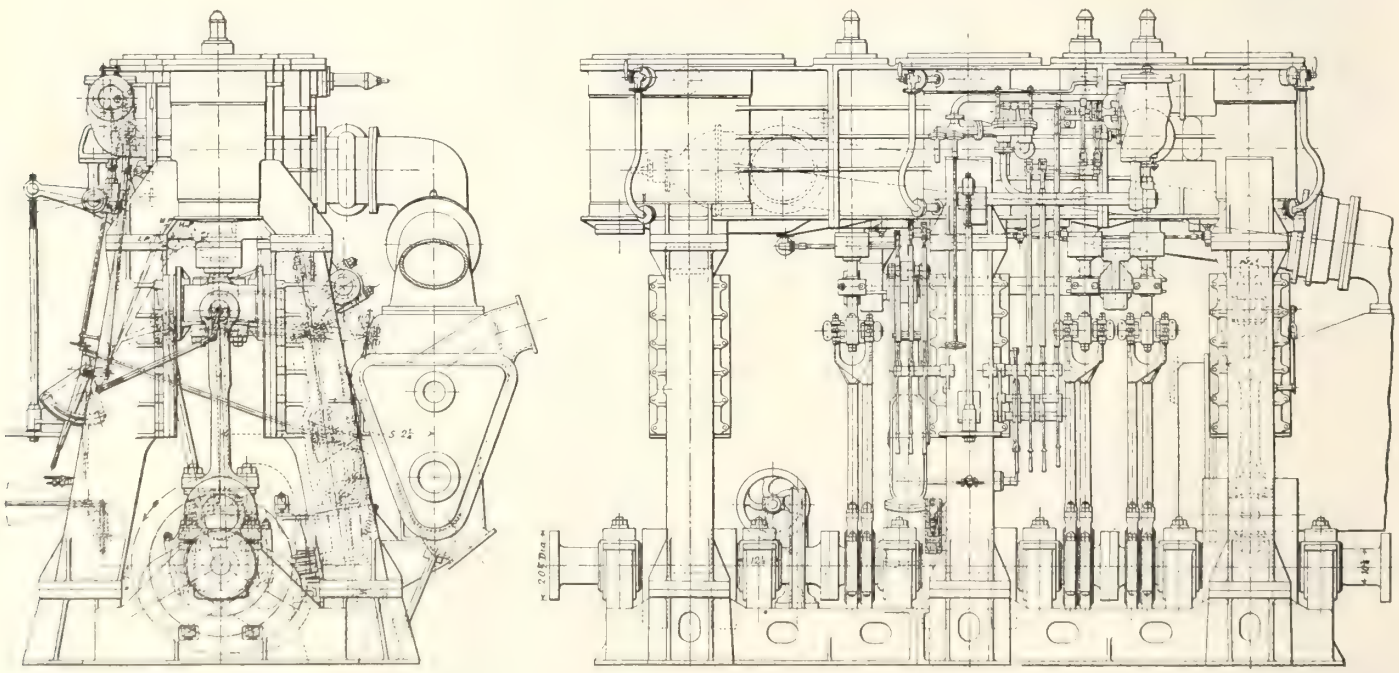

FIG. 6. PROPELLING MACHINERY, CAR FERRY, "SCOTIA II."

wings, in order to afford the maximum of deck space for the accommodation of the railway trains. The boilers are also arranged in the wings of the ship, enabling the uptake to be easily and suitably connected to funnels at the side of the hull.

From the general arrangement of the boilers and engines it will be seen that there are four single-ended boilers, which are each 15 ft. 3 in. in diameter by 10 ft. 9 in. long, constructed for a working pressure of 160 lbs. per sq. in. under natural draught. More than adequate tube surface is provided, as a considerable amount of heating is required for ship purposes, special connections being led from the boilers to various parts of the vessel. Each boiler has an independent connection with the main steam-pipe, so that any one boiler may be put

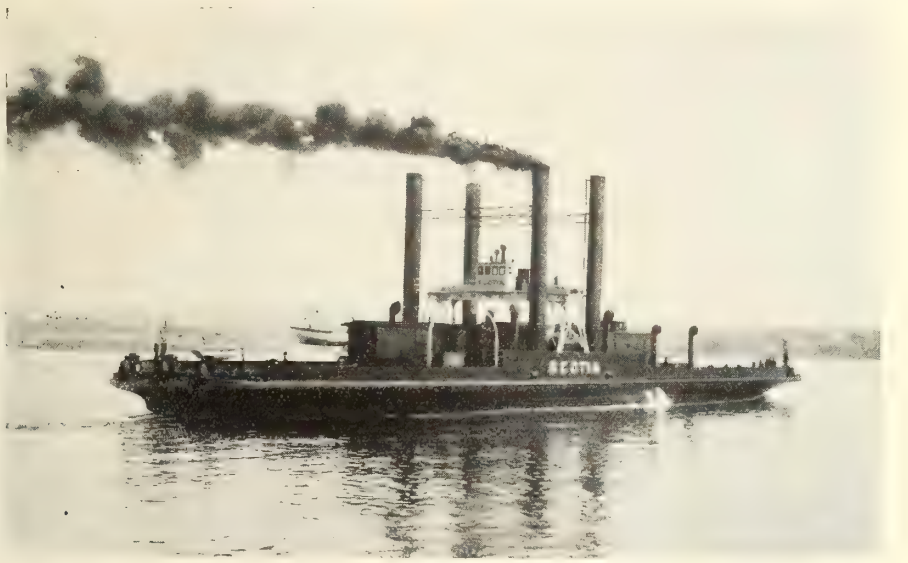

FIG. 7. CAR FERRY "SCOTIA I."

out of action. The coal bunkers are arranged at the forward and aft ends of the boiler-rooms, and these are filled from hatches from the upper, or train, deck.

The main engines, of which the end and front elevations are shown, are of the standard type of the Wallsend Slipway & Engineering Co., Wallsend-on-Tyne, who are responsible for the whole of the propelling machinery of the ship. The firm has had considerable experience in the design of engines for ice-breakers, and a study of the illustrations will show that special consideration has been given to provide against the shocks due to sudden stoppages of the propellers when working against ice.

The engines are of the single-screw triple-expansion inverted direct-acting surface-condensing type, each working on three cranks. Normally they will be coupled up to work together the bow and stern propellers, but there is a short portable length of shafting between the two engines, by the withdrawal of which the units can be operated independently.

The cylinders in each engine are respectively 21 in., 34 in., and 54 in. in diameter, with a stroke of 30 in. The crank-shafts are of the built type, 10¾ in. in diameter, each shaft being in three interchangeable pieces. The thrust-shafts are of forged ingot steel, 10¾ in. in diameter. The thrust-blocks are of cast-steel of special design, to withstand shock; the line-shafting is also forged ingot steel, 10 in. in diameter, and the propeller-shafts are of forged ingot steel, 12 in. in diameter, each shaft being fitted with a Cederval gland. Each propeller has four blades, and is made of nickel steel, extra thick, for working amongst ice.

There is one condenser common to the two engines. It is of the Weir "Uniflux" type, and is placed on the port side centrally, being carried on the columns of the two high-pressure cylinders. This simplifies greatly the exhaust-pipe arrangement from each of the low-pressure cylinders. The air-pumps are separate, and are of the Weir dual type, 18 in. by 10 in. by 15 in. Two sets of independently-driven 12½-in. centrifugal pumps are fitted; one of them is sufficient for the maximum duty, the other serving as a stand-by.

The feed-pumps are located at the forward end of the main engine-room on the port side. These are of the Weir type, 7 in. by 9½ in. by 24 in. stroke. Alongside are placed the fire and bilge pumps, which are 7½ in. by 7½ in. by 6 in. stroke, while in the wings are the general service pumps and other auxiliaries.

The whole of the auxiliaries connected with the propelling machinery are placed on the port wing, the starbord wing being reserved for the electric generating set, air-pumps, air-receivers, for ship service, and for engineer's stores.

The machinery was designed to indicate 3000 horse-power, and on trial this was easily attained.

NORTHERN NAVIGATION CO. S.S. "MAJESTIC" BURNED

THE steamer Majestic, owned by the Northern Navigation Co., was totally destroyed by fire on Dec. 15, as she lay at the old elevator dock at Point Edward, Ont., and was responsible for a serious fire on the steamer Saronic, which is moored at the company's dock at Sarnia, although the boats were well apart when the fire started on the Majestic.

The fire was discovered shortly before 11 o'clock in the hold of the steamer, and spread very rapidly to the upper works, which, being very dry, were soon a mass of flames from one end to the other, in spite of several streams of water that were thrown on the vessel by the tug Sport of Port Huron.

Shortly after one o'clock the company decided to take the burning boat to Sarnia Bay, and place her alongside other old wrecks, where she could not do any damage by sinking. On the way down the river in tow of a tug the line parted, and the high wind drove her in on the Sarnia docks. She ripped up the Clark dock for many feet, and then banged about until she came alongside the Saronic, where she hung for some minutes. The tug then secured her again and placed her in the bay. A few minutes later the Saronic broke out in flames, and but for the work of the Reid Wrecking Co. steamer Manistique, she would also have been a total loss.

The Majestic was operated on the Georgian Bay run from Cleveland and Detroit, and made special excursions each summer. She was built in Collingwood in 1895, and was 209 feet in length, with a beam of 39 feet. The loss is placed at $100,000, and the insurance at $90,000 on the Majestic. The loss on the Saronic is estimated at $25,000.

A Profitable Season.—The Canada Steamship Lines is reaching the end of its season on the lakes. Reports indicate that, since the movement of the Western crop commenced, there have been splendid profits. Another important feature in connection with the company's programme is that, instead of tying up all boats for the winter, there will be sixteen of them in the outside service. The last of this number left Montreal for the Atlantic on December 2, and attention need only be called to the abnormal rates now prevailing for ocean freights to emphasize the importance of this new departure.

Dominion Wreck Commission Inquiries and Decisions

Following the proceedings of a vessel stranding or collision inquiry is fascinating alike to the mariner and landsman. Much food for thought is always available, and in not a few instances it seems well nigh impossible to reconcile our conception of disaster prevention achievement when confronted with a detailed recital of the circumstances which contribute to many marine tragedies, not only in our own waters but the wide world over.

"EDWARD LONG" — "BLANCHE"

A FORMAL investigation into the causes which led to the sinking of the tug Edward Long, whilst moored near the foot of the Rideau Canal Locks, Ottawa, was held at Montreal on November 10, before Captain L. A. Demers, F.R.S.A., F.R.A.S., Dominion Wreck Commissioner, assisted by Captain Francis Nash, and Captain Charles Lapierre, acting as nautical assessors. The investigation was held at the request of the Department of Public Works, as a result of a claim by Captain Long, owner of the tug Edward Long, that the Public Works tug Blanche, caused the sinking of the former vessel. A. E. Fripp, K.C., M.P., represented the interests of Captain Long, while the Department of Public Works did not secure the services of counsel, being represented by Mr. Kastella, an officer of that department.

Blanche Officer's Evidence

The first witness examined, A. Morgan, officer in charge of tug Blanche, stated that he held no certificate entitling him to command; but was nevertheless engaged as master; that the Blanche was about 65 feet long, and could make about ten miles an hour; but he was not sure of any other particulars regarding her.

He carried three of a crew all told, and the duty of the tug was to attend to the dredge which had been working in the vicinity of the accident for about two weeks, clearing out some old wrecks. On the evening of November 12, he left the port side, or the inward side of the dredge, backing slowly for a few moments, then stopping, his vessel having gathered stern way which he at first averred was four miles; but later stated was much slower. He came in close to, and in fact touched the stern, on the starboard side of the Edward Long, or rather grazed it, there being no shock as far as he could remember. He was reminded of the touching at the time by the engineer; but it never entered his mind that he had caused any damage.

There was no wind and very little current, although the latter, he admitted, after examination, might have helped to throw his vessel towards the Edward Long. He did not know whether his vessel had a right or left-handed propeller. He stated that insofar as he could recollect the Edward Long never had a watchman on board, and was lying with her bow on the beach and the sterr afloat, the beach really at that point being a bed of sawdust. He did not see any ropes holding the vessel fast.

Captain Long's Evidence

Captain John Allan Long stated that his vessel was built in 1905, and was 51 feet over all, of about six tons register, with simple engines. He had not sailed her last season as he had no employment for her. He fastened the boat by a rope from the bow ashore, and a line from the starboard quarter astern to a boat house. When he saw his vessel a day or two previous to the casualty, she was afloat, and was drawing about 18 in. forward and 3 ft. aft. There was also 3 ft. of water under her bow. As she was in an unfrequented place he did not think it necessary to have a watchman on duty, except to prevent destruction by boys, and for the latter purpose his son had asked Mr. Berthiaume, owner of the boat house to which one rope was fastened, to have an eye on her, without a formal engagement. He asked the engineer of the dredge to raise his vessel, and was promised that such would be done, but it was not. He brought to the attention of the court a remark by an engineer that they would raise the vessel if nothing further would be said about it.

Blanche Engineer's Evidence

The engineer of the Blanche, Plante, by name, stated that he held no certificate, and did not know anything about the accident, nor did he recollect having called the master's attention to the grazing of the Blanche against the Edward Long. His memory about any incidents prior to or at the time of the casualty was a perfect blank.

Dredge Officer's Evidence

The officer in charge of the dredge, Wm. McInnch, who was next called, stated that he had instructed the master of the Blanche, to remove a boat house and the tug Long some distance away to permit a wider space for the operation of his dredge. To his knowledge the Blanche never touched the Edward Long. He could not say what caused the latter to sink. He admitted having promised to raise the tug; but refuted the statement that he had said there would be nothing said about it. As he was afterwards stricken ill with typhoid fever he was unable to raise the vessel, and there was no one on board to whom he could entrust the work.

As the foregoing contradicted the evidence of the master of the Blanche, the latter was recalled and said he never received orders to remove the tug Edward Long or boat house; but that he had orders to move a barge, which he carried out.

Boat House Owner's Evidence

Louis Berthiaume, owner of the boat house, said that he had moved the boat house to which the Edward Long was moored by a one inch line from the port bow, and one amidships, her stern projecting out from the end of the boat house. He saw the Blanche come in contact with the Edward Long at her stern, forcing that part of the vessel against the corner of the boat house, snapping, through the pressure, the bow line. He immediately got the Edward Long alongside his pontoon, and fastened her again, allowing some slack rope. This occurred about 4.50 or 5 p.m., and at 6.30 p.m. he heard a noise, and looked through his window and saw the Edward Long had sunk. Although he notified the interested parties; nothing was done that night or the day after to raise her. He was not engaged by Captain Long or anyone else to watch the vessel beyond the request to chase boys who were taking pleasure in breaking windows in the cabin, and carrying away small articles.

The sinking of the Edward Long at 6.30 p.m., was denied by the engineer in charge of the dredge, who said he went to tea at 6 p.m., and when he came on deck the Edward Long was still afloat. He could not say when she sank.

Summary

Although, but five witnesses were examined, more contradictory evidence was submitted than is usual in more important collision cases. The court finds that the evidence of the master of the Blanche (Morgan), and of Louis Berthiaume, is that which they must accept to arrive a solution of the matter.

We note that the master of the Blanche was occupying a position which he was not competent to hold, both as regards possession of a certificate, and as to his absolute lack of knowledge of handling vessels, his former experience being as a fireman. His statement that he may have touched the Edward Long, or rather did touch her, is accepted by the court as a certainty; but to what extent of damage the actual contact occasioned, we are unable to determine. If the Edward Long was lying against the pontoon,—one-third of her length

beyond the end,—the least pressure brought to bear on her after side would force her against the corner of the pontoon.

When the bow line parted, it shows that the strain occurring was sufficient to open up the seams, and allow access to water in a slow or rapid manner. As the boat is supposed to have sunk two hours after the impact, the wound caused could not have been a very severe one; therefore, the contact of the Blanche against the Edward Long, was but slight. Although the Blanche had not time to gather much sternway her weight was sufficient to create such damage.

The court finds that the captain did not appear to exercise caution. Knowing as he did that the Edward Long was nearly in his path he should have had a spring on the dredge to swing his stern in such a position as to preclude any possibilities or probabilities of a mishap, and that he did not take any precaution we are quite convinced.

With regard to the Edward Long we are of opinion that all floating property should be supervised and watched, no matter where it may be. We are ready to waive aside that obligation; but on the other hand we claim that had there been some one sufficiently interested in this vessel,—the moment she appeared to have been struck, or pressed against the side or corner of the pontoon by the Blanche, the pressure being strong enough to part the bow line,—to have examined the damage at once, immediate steps might have been taken to haul her towards the beach and ground her. Even then in the event of her filling up, a great part of her hull would have been above the surface, and the damage inflicted could have been examined and proved. It does not appear that any efforts were made, either on that day or the day after, to attempt to raise the boat, showing that little value was attached to the property; but that it was left to the mercy of the elements.

For the reasons above given the court finds that the Blanche was primarily the cause of doing damage to the Edward Long, but as the master does not hold any certificate he cannot be dealt with by the court. With regard to the Edward Long, had there been someone on board to investigate the damage, the sinking of the vessel would not likely have occurred, and therefore we find Captain Long equally to blame for not having taken immediate steps to protect his property as explained in our summary.

The court cannot adjudicate as to amount of damages, its jurisdiction being only to ascertain who is at fault.

"BATISCAN" - "BENGORE HEAD" COLLISION IN ADMIRALTY COURT

IN the Admiralty Court, Montreal, on December 1, Mr. Justice Dunlop rendered judgment, holding the steamer Batiscan to blame for the collision with the steamer Bengore Head in the lower St. Lawrence on August 1, last. His lordship accordingly ordered that the claim of the Ulster Steamship Company, owners of the Bengore Head, be maintained against the Sydney, Cape Breton & Montreal Steamship Co., owners of the Batiscan, the damages sustained by the Bengore Head to be assessed by W. S. Walker, K.C., registrar of the Admiralty Court. The counter-action against the Bengore Head was dismissed with costs.

The Ulster Steamship Co. sued the Batiscan for $150,000, and the Sydney, Cape Breton & Montreal Co. made a counter claim of $50,000 against the Bengore Head, each steamship holding the other responsible for the collision off Cape Salmon on the date named. The Bengore Head was sailing from Montreal with a general cargo and the Batiscan was sailing from Sydney, N.S., for Montreal, with coal. There was a heavy fog on the channel at the time the ships met.

Notes of the Judgment

In his judgment, Mr. Justice Dunlop said in regard to the Batiscan: "I find in Captain Green's evidence a good many conflicting statements. The scrap log and officer's log book contradict his disposition in many important particulars, unless the incidents were not properly entered. I am of the opinion that, when the Bengore Head appeared in sight, the Batiscan must have ported her helm, as if such had not been the case the impact or place of collision would have been at right angles.

"The examination of the damage to the Bengore Head, especially on the main deck, indicates that the Batiscan struck her at an angle of about forty-five degrees, and this could only be done if her helm had been ported; evidently the Batiscan must have been going at full speed astern, and the damage also indicates that she had considerable way on her when she struck.

"Batiscan" Captain at Fault

"I think the evidence shows clearly that Captain Green was at fault and acted carelessly, showing poor seamanship. It would also appear that the pilot seems to have agreed to all suggestions made by the master of the Batiscan as to the different evolutions prior to the collision and made no objection or protest against them in any way. I am of the opinion that when the collision took place the engines of the Batiscan should have been stopped in order to remain in the wound inflicted by the collision until it had been found that the Bengore Head could remain afloat.

"Another very important fact is that the condition of the damaged hull and cargo of the Bengore Head demonstrated that the Batiscan had considerable way on her at the moment of impact, in spite of the evidence of her master that his ship had sternway to the extent of two knots.

"The sounding several times of two prolonged blast signals was a wrong signal when the Batiscan still had headway. The captain of the Batiscan did not obey Article 16 of the Rules of the Road, which requires the ship to stop her engines and to navigate with caution when hearing the fog signal of a vessel apparently forward of her beam."

Bengore Head Part

On the other hand, the judge finds that no ship could have complied with the rule aforesaid better than the Bengore Head did by porting slightly to give the Batiscan wider berth and feeling her way slowly past her. In the judge's opinion, all through, the Bengore Head complied with Articles 15 and 16 of the International Rules of the Road, and the Batiscan violated them. Everything done on the Bengore Head was consistent with good navigation and seamanship, even to the last moment—reversing the engines and hard-a-porting her helm when the collision was inevitable, evidently with the intention of minimizing the shock of the collision.

She was going slowly when she was struck; she was struck on the port side; she had kept her one-blast signal going; she had stopped to ascertain the exact bearing of the Batiscan before proceeding; she had navigated with caution on hearing the two-blast signal of the Batiscan; and she did, in fact, all she could to avoid the collision.

"I am consequently of opinion," concluded His Lordship, "that the Batiscan is entirely to blame for the collision and its consequences. Therefore, the claim and action of the plaintiff wherein the steamship company, owners of the Bengore Head, was plaintiff, and the Batiscan defendant, must be maintained with costs; and the defendant and its bail in said cause are condemned to pay to the said plaintiff the amount to be found due on its claim and in costs, and doth refer the same to the deputy registrar, assisted by merchants, to report the amount due.

"I am further of the opinion that the plaintiff's claim wherein the Sydney, Cape Breton & Montreal Steamship Co., owners of the Batiscan, is plaintiff, and the Bengore Head is defendant, should be dismissed with costs."

F. E. Meredith, K.C., and A. R. Hol-

den. K.C., appeared for the Ulster Steamship Co., owners of the Bengore Head; and Mr. Shanks, with Mr. Aime Geoffrion, K.C., as counsel, appeared for the Sydney, Cape Breton & Montreal Steamship Co., owners of the Batiscan.

SIGNALLING AT SEA

THE British Board of Trade has issued an important order to masters and officers of the mercantile marine on the subject of signalling at sea. In view of the fact that the master of a ship failing to respond to a signal made to him by one of his Majesty's ships is liable to heavy penalties under the Defence of the Realm Acts, it is of the utmost importance at the present time, it is stated, that every British merchant ship should be in a position to receive and transmit signals both in the Morse and semaphore codes. The safety of the ship may depend upon a knowledge of signalling. Candidates for certificates of competency as master or mate will, therefore, be required to attain a certain standard of proficiency in reading and sending messages in these codes.

According to the Manchester Guardian, after January 1, 1916, candidates will be expected to send and read messages in semaphore at a speed of eight words a minute, in Morse—both flashing and flag waving—at a speed of five words a minute, the average length of a word being taken to be five letters. At the outset, candidates who fail to attain the required speeds will not be regarded as having failed in the whole examination provided that they pass satisfactorily in the other subjects, but in due course the attainment of these speeds will be compulsory upon candidates for certificates of all grades.

NEW SUPERDREADNOUGHTS

ACCORDING to announcements recently made in parliament, it is expected that before the end of the year fourteen new superdreadnoughts will have been added to the British navy since the outbreak of the war. The names of thirteen of these new battleships follow: Queen Elizabeth, Agincourt, Canada, Barham, Royal Sovereign, Revenge, Ramillies, Warspite, Tiger, Erin, Valiant, Malaya, Resolution. A fifteenth super-dreadnought, which will probably bear the name of Repulse, will be ready early in the new year.

The Queen Elizabeth, Tiger, Warspite, Agincourt, Erin and Canada were commissioned soon after the declaration of war, and there is reason to believe that the Barham and the Valiant joined the fleet during last spring, that the Malaya was ready by August and that the Resolution and the Ramillies will go into service some time this month.

FRENCH MERCHANT MARINE

THE French Cabinet instructed the Ministers of Finance and Marine to introduce in the Chamber of Deputies in the name of the Government a measure authorizing the purchase by the State of a merchant fleet of fifty ships. These vessels are to include tank steamers for the transportation of petroleum, and cold storage vessels for the transportation of frozen beef to provision the population of France.

The project has been under consideration for several months. It was proposed at first to buy 100 vessels with a total tonnage of 500,000, at an estimated cost of $30,000,000. Negotiations undertaken in England under the previous ministry, produced no results. The increasing cost of food and other necessaries and the rise in freight rates led the new cabinet to take up the question again, and it was decided to make a beginning with fifty vessels.

Members of the Chamber of Deputies are much interested in the project, and it is expected the government's bill will be adopted. A semi-official note says the project involves the purchase of from fifty to sixty vessels, at a cost of about 100,000,000 francs. The vessels would continue to sail under the British flag and with British crews, the note adds, as all nations have been forbidden to transfer flags during hostilities.

WHAT ARE MONITORS?

THE bombardments of the Belgian coast, carried out by a squadron under the command of Admiral Bacon, claim our attention.

To commence with, General French has let us into the secret of the important naval post to which Admiral Bacon was appointed. This officer will be remembered because of his association with the submarine service in its early stages, as a member of the committee which approved of the Dreadnought design, and as the first captain of the Dreadnought. When war broke out, Admiral Bacon was connected with the Coventry Ordnance Works, and some criticism was passed on the appointment of a retired officer in preference to the rear-admirals still on the active list.

Some years ago the Germans carried out a series of experiments with the view of testing the efficacy of concealed shore batteries against ironclads, and the conclusion was reached that no country would risk her fighting ships in an attack on a defended coast.

After the first surprise attack on the Belgian coast by Admiral Hood's squadron, the enemy immediately studded the coast with batteries. No doubt they hoped that this would act as a deterrent to further attempts by our ships, but they had reckoned without the skill of our naval authorities.

Vessel Features

The outstanding features of these vessels, which as a class are named after Ericsson's first "monitor," are shallow draught, small freeboard, low speed, heavy armament, and fairly efficient protection. The shallow draught renders them capable of working in shallow water, and this is an advantage in two ways: it permits of their working close inshore and in waters too shallow for a submarine to manoeuvre in without running suicidal risks. The shallow draught also means a small underwater target, which compensates for the lack of defensive qualities incidental to the slow speed.

The low freeboard makes these vessels a very small target for the land gunners. Briefly, the monitor represents the maximum hitting power carried in the smallest possible space, big offensive qualities in a small target.

These little vessels have overcome the elaborate plans of the enemy for the defence of the coast. They are the best possible reply to the enemy's move, and they show that, in spite of all that is urged against our administrators, we do possess men capable of finding the flaw in the enemy's plans, and resourceful enough to develop the means of profiting by their discovery.—Liverpool Journal of Commerce.

Panama Canal Slide Troubles.—Owing to the tying up of the Panama Canal by the recent slide, many employees, mainly in the operating divisions, are being furloughed or given vacations, which is taken to indicate that the canal will remain closed for a much longer time than was first expected. It has been learned that it is the intention of Major-General George W. Goethals, Governor-General of the canal zone, to force a temporary channel through the slide as quickly as possible and pass through the waterway a few ships which have been waiting since the canal closed, and then again shut off traffic through the canal until all danger of slides has been definitely ended. This probably will be not less than six months, according to the best available estimates. The condition of the slide remains virtually unchanged, though slight gains are now being made by the dredges against the mass which is blocking the canal.

Port Arthur, Ont.—From September 1 to December 11, inclusive, 166,346,965 bushels of grain was shipped from Port Arthur and Fort William, the greatest volume in the history of the head of the lakes. The nearest approach was in 1913.

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Embracing the Further Discussion of Previously Published Articles, Inquiries for General Information, Observations and Suggestions. Your Co-operation is Invited

CHRISTMAS ON A SAILING SHIP AT SEA

By Capt. Geo. S. Laing.

TO the great majority of people, Christmas means a day of spiritual thankfulness. On this the greatest of days, the scattered members of families try hard to get under the parental roof for mutual rejoicing. Even folks with little or no sunshine in their ordinary dispositions are apt to take on a grain of affability about Christmas time. The word home is certainly weighed up at Yuletide, and the proverbial silver lining to life's dark cloud is brought to our mind's vision.

In some of the wild and lonely paths of life, the word home has little meaning on the surface. The absence of women and children and the utter impossibility of domestic envoironment makes life a very humdrum existence. This is the state of affairs on foreign-going sailing ships whose single trips often run into ten and twelve thousand miles, and a round voyage is commonly eighteen months or two years away from home.

Christmas spent under such peculiar circumstances is necessarily devoid of the overflowing mirth that is part of the day on shore, but nevertheless, sailors as a rule make as much of December 25th as they possibly can, and an instance of how the day is spent follows.

Change of Routine

If within the tropics and far enough from the equator to have a steady trade wind, Christmas is generally very enjoyable. The morning "watch" give the decks a good scrub, and shine up all the brass about the poop and quarter-deck. At seven a.m., the ship looks clean and trim for the holiday, and instead of getting out tar pots and marlin spikes from the boatswain's locker, as we would do on other days, every one makes towards the fo'c'sle or half deck house and prepares to make some alteration in his facial expression.

Those who have not shaved for months may try to get rid of their sea-grown beards. A few will have their hair cut, whilst all will dive into the depths of their trunks or sea kits and pull forth one or two pieces of wearing apparel that do duty on high days and holidays.

When eight bells strikes, i.e., 8 a.m., the most of the crew are in new togs. One or two have red flannel shirts on, to apparently offset a few others who have blue flannels on. One or two old salts have donned shirts that resemble a barber's pole in colors. This gaudy rig is made specially for fo'c'sle hands, and is sold from the vessels out-fitting department, known to Jack as the "slop chest."

Sailors who have been so unwise as to come away on a long voyage without a proper stock of clothing are bound to purchase from this department store. Talk about bargains, why, if a 50c shirt and a 25c cap are sold for $5, the captain is simply giving the material away.

At the cook's dispensary a special breakfast is handed out, that's why you notice each sailor grinning as he looks into the mess-tin and sees new sights. After breakfast, the shaded parts of the deck are found to leeward of the sails and four tars indulge in a game of cards. Two thrifty fellows have brought out their "shore togs," and are airing and brushing them, whilst the hard hat, which has been sown up in canvas and nailed to the fo'c'sle roof for nearly a year, is also dragged into the open for inspection.

Diversity in the Day's Activities

One talented sailor (a Frenchman), for we have five nationalities represented in the fo'c'sle, is painting a picture of the ship on the inside lid of a new sandal wood trunk that was purchased in Calcutta. Another two are busy putting miniature models of the ship fully rigged inside of bottles. This is a very tricky thing to do, as all equipment is complete, and the masts are not raised till the whole model is beyond the neck of the bottle. Then by pulling a string the spars and rigging all assume their oppointed positions in the wide part of the improvised case.

A young Norwegian is preparing the down breast of an albatross for his sweetheart. This giant of sea-birds had been caught between Cape of Good Hope and Australia, and although the skin and feathers have been treated with alum and sunshine, the whole thing needs periodical attention if a good muff is to be made from it.

The Apprentices

What are the apprentices doing? They have rigged themselves up in light tropical garb of different grades and have donned their uniform cap on which is displayed the company's house flag in the badge. Two of them have written an extra page in their diary, two others are trying to work up the ship's position, the captain having given them the necessary data from sextant, chronometer, and nautical almanack. The two "first voyage" boys are rolling round the main hatch playing with two monkeys that were purchased from the Japanese boats in the Straits of Sunda. Two cockatoos from Australia are also on the hatch, and the noise is awful. Would you like to know the prices paid for these pet birds and animals? The time was when I would not divulge such a secret. The monkeys cost a pair of scissors, a cricket belt and some ship biscuits. The cockatoos demanded a pair of pants and a pair of boots.

Sea apprentices wear out an awful lot of clothes in this manner, and the termination of each voyage finds their home-stocked trunks minus clothing, but half full of shells, corals, preserved flying fish, bottles of sealed gulf weed, belts made from Chinese cash, gorgeously carved sandal wood fans, samples of Indian chutney and curry powder, silk shawls for mother and sisters, and a diplomatic box of cigars for father, for he would know that the quantity of wearing apparel with which they started out should last for three or four years.

Christmas Dinner

At eight bells (noon), an extra dinner is served up, with plum pudding and canned meat the main dishes; perhaps the steward has put an extra dash of water into the lime juice allowance to give that daily drink a festive appearance. In the afternoon, the captain and mates in dandy white suits bought in Hong Kong may stroll along the main decks at different times and eye the Christmas joy that has shown itself in so many different ways.

After nightfall during the second dog watch, i.e., 6 to 8 p.m., the crew indulge in singing a few sea-songs, and if a tin whistle artist is on board this is the night when he uses his wind. The concertina and accordion are frequently carried, too, and you are likely to hear both foreign and home tunes. In the way of athletics, a few will try the hand over hand method of climbing on a suspended rope, whilst others will see who can hang on longest to a rope with one hand sustaining the whole body. Even a tug of war may be pulled off along the deck.

The Officers' Christmas

What do the captains and mates do on Christmas? They look, and eventually stare at all the photos in their albums; with an extra look at the pictures of

their wives and children. They also bring on deck to air, a few of the more costly presents and curios that their positions can afford, ostrich feathers from Cape Colony, paintings from China, plaques on ivory rollers and ornamented with silk-sewn birds, being among the number. Packages of special tea, preserved ginger, and boxes of cigars are also in view. This ship has probably been at eight or ten of the globe's greatest ports and quite a prodigious quantity of curios may be found on board.

Such is Christmas on a sailing ship. It is one of the most solitary experiences known to man, and if, on that holiday evening, the mate said to the captain, "I wish I knew enough to work on a farm," you could appreciate the situation.

Next day it's tar pots marlin spikes and serving mallets, but a day's march nearer home and those we care for.

The class of sailing vessels spoken of here are generally on runs of 100 to 150 days, touching no ports en route. Whilst the Panama Canal has shortened distances, the "wind-jammer" will never be ousted entirely, in fact with the progress and development of explosive engines, the sailing vessel is again to appear in a new role, that of an auxiliary craft.

QUICK-FIRING GUNS

THE rapid development of artillery during the last few years has naturally led to the coining of a number of phrases to express the difference between the various types, and distinguish the new from the old and obsolete; while the rapid education of the general public in the elementary principles of modern warfare has brought some of these phrases into common use. It not infrequently happens that a whole series of remarkable improvements are designated for general use by a single expression. An excellent example of this is the term "quick-firing" as applied to modern gunnery.

Less than twenty years ago, it was recognized that the gradual development of the field gun had made so many changes necessary in the tactics of infantry that a radical improvement in the speed and accuracy of artillery fire was desirable. Men were no longer fighting in masses in the open, and they had found it more effective to offer only a fleeting target to the gun. Consequently the time required to load, run out, and aim the gun had to be reduced if the weapon was going to be of much use. Loading was enormously accelerated by the adoption of the single-acting breach mechanism, combined with a device for ejecting the empty cartridge case. The running in of the old gun to the firing position was necessary, because the recoil after firing was taken up by the gun and carriage as a whole. Hence, the weapon had to be run forward, set in position and re-aimed.

The Modern Gun

In the modern gun the barrel only moves, the energy of the recoil is taken up in an elastic press, and the barrel is returned to its original position by a spring. After firing, the modern gun returns instantly to the position it occupied before firing, and generally this does away with re-aiming. The improvements enumerated were first adopted by the French in 1897, and their famous 75-mm. gun can fire from twenty to twenty-five rounds per minute. Germany carried out an elaborate series of trials, extending over a long period, but it was only in 1905 that they adopted the quick-firing gun.

In the services the Maxims, Gatlings, and other automatic feed guns are not spoken of as quick-firers, that name being given to all weapons which are loaded by hand. Thus the 6-in. naval gun is a quick-firer and represents the maximum size of a quick-firing gun in the navy. The shell weighs 100 lbs., and can just be man-handled. The 7.5 in., the 9 in. and all heavier weapons are provided with regular hydraulic hoists and loading arrangements.

At the other end of the scale is the little 3-pounder, and from the 6-in. to the 3-pounder the firing arrangements are sensibly the same. Naval guns of greater than 6-in. calibre differ in the first instance from the 6-in. gun, in that the loading is done by machinery. With the main armament weapons of our battleships, the size and weight of the breech blocks renders it necessary to open and close the breech by hydraulic power; but the principle of the recoil arrangements is the same throughout.—Liverpool Journal of Commerce.

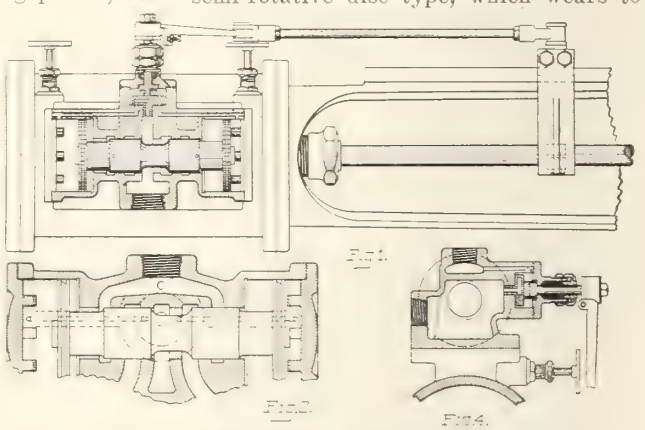
STEAM PUMP WITH NEW TYPE VALVE

A STEAM pump with a new type of valve gear, which embodies some very unique features, has recently been placed on the market by the American Steam Pump Co., of Battle Creek, Mich.

The pump will be known as the "American-Marsh," this name having been chosen because of the fact that the pump will combine some of the best features of the well-known "American" and "Marsh" pumps which have been manufactured by this firm for many years, and of which they claim to have over 130,000 in successful operation.

As will be noted from the accompanying cut, the pump has a steam valve, which is mechanically actuated, and which is also self-governing. The fact that it is mechanically actuated insures positive action at all times, while the self-governing device allows only just enough steam to enter the pump to do the required work. If the work is light, the admission steam is cut down, while, if the work is heavy, the portage is automatically enlarged. This feature insures an unusually low steam consumption.

The steam valve is of the balanced piston type equipped with expansion rings, while the auxiliary valve is of the semi-rotative disc type, which wears to a perfect seat. There are no slide valves to wear and no noisy links or tappets in the valve gear. In action it is claimed to be perfectly quiet.



STEAM PUMP WITH NEW TYPE VALVE.

It is claimed that this pump cannot hang up even under the most severe conditions, and even if the suction line is broken the pump will not race. The length of the stroke is regulated by two adjusting screws located at the fulcrum of the lever arm.

Shipping Casualties in November.—The number and net tonnage of British vessels, respecting the loss of which reports were received at the Board of Trade during November, and the number, and the number of lives lost, were:—Sailing vessels, thirty-five, net tonnage 4,977, lives lost six; steamships fifty-three, net tonnage 61,072, lives lost 646. Among this number were twenty steamers of 48,523 tons, sunk by German warships, ten steamers of 4,654 tons, sunk by mines, and one steamer of 864 tons, sunk by a German warship or mine. Four hundred and ninety-five lives were lost in steamers sunk by German warships, of which 315 were lost in the Ramazan, and 167 in the Marquette, 58 in steamers sunk by mines, and 20 in steamer sunk by a German warship or mine.

OWEN SOUND WELCOMES C. P. R. STEAMERS

THE city of Owen Sound signified its appreciation of the return of the full fleet of the Canadian Pacific lake steamships to its harbor, by a banquet on Friday night, Dec. 14, tendered by the Board of Trade to the officials of the company and to the officers of the fleet. The steamers arrived in at 3 o'clock from Port McNicholl, the Athabasca leading, as she did when thirty-one years ago the line was established with Owen Sound as its headquarters.

Mayor McQuaker was toastmaster at the banquet. Supt. Byron of the Canadian Pacific lake steamships department, was the guest of honor, and expressed his appreciation of the reception tendered. The steamers had come to Owen Sound to undergo extensive alterations, and he was pleased that Owen Sound was able to successfully compete with several other ports on the lake for the work.

W. S. Middlebro, M.P., H. B. Smith, president of the Northern Navigation Co.: J. McLauchlan, Col. W. N. Chisholm of the 31st Regiment, and Mr. Justice Sutherland were among the speakers, the list of which included also the captains of the several vessels wintering there.

AUSTRALIA LAUNCHES FIRST BIG CRUISER

THE launching of the cruiser Brisbane, the middle of last month, marks an epoch in the history of the Australian Commonwealth, inasmuch as the Brisbane is the first cruiser to be built almost wholly by any of Britain's Overseas Dominions. She is the largest vessel of any type yet set afloat under the British flag in the Southern Hemisphere. Her tonnage is 5,400, and she is a sister ship of the Sydney and the Melbourne.

While it has taken longer to build the ship than it would in a British yard, it must not be forgotten that the force which has been busy upon her for about two years at the Cockatoo Island naval dock at Sydney had to be created for the purpose. The boilers were built entirely at the Cockatoo plant and, while the material was imported, the turbines themselves were assembled by the engineering staff on Cockatoo Island.

The construction of the latest additions to the Commonwealth Navy was under the direction of two experts sent out by the Admiralty, and it is hoped to have her in commission about the beginning of August next. The largest war vessels launched previously in Australia are the destroyers Derwent, in December, 1914, and Torrens, in August last. As soon as practicable, another cruiser of the same type as the Brisbane, to be called the Adelaide, will be begun at the Cockatoo Island yard.

Naturally, the launching of the Brisbane was made an event of note. She was named by Mrs. Andrew Fisher, wife of the Prime Minister, who is from Queensland, after the capital of which the warship is named. The Governor-General, Sir Ronald Munro Ferguson, Mr. Fisher, various of his governmental colleagues and numerous others in public life attended the ceremonies. One of the guests was the American consul-general, Mr. Brittain.

DREDGING TROUBLES IN BRITISH COLUMBIA

A LARGE-SIZED scandal is developing in connection with British Columbia dredging. The Auditor-General, who has been making some investigations during the past few weeks, has, it is understood, held up payments to contractors.

The recent "resignation" of John L. Nelson, who was appointed Superintendent of Dredging for British Columbia by Hon. Mr. Rogers in 1912, is one of the first developments so far made public.

Coal Purchase Prices

Shortly after Nelson assumed the position there were rumors in British Columbia that the patronage and middleman system was being exploited to the full. One case has recently been investigated by H. P. Hill, of Ottawa, who was sent out by the Government as a special commissioner. Briefly what he found was that, through the connivance of Nelson, coal for the Dominion dredges and tugs of the Pacific Coast was supplied through W. H. Price, secretary of the Victoria Conservative Association, who secured the order for Kirk & Co. at $7.50 per ton. The evidence taken by Mr. Hill showed that Price got a rake-off of fifty cents per ton from Kirk & Co., and that the coal could have been bought from other coal dealers at $5.25 per ton.

Nelson swore that he had certified to the prices charged as being fair and just, even after repeated notification had been given him that coal could be got cheaper from other firms. The loss to the Federal Treasury on the coal contracts alone is shown to have been several thousand dollars.

Padding of Dredging Accounts

A much more serious and sensational scandal in connection with the padding of accounts for dredging in Victoria harbor has been brought to the attention of the Auditor-General here, and will be further investigated when Parliament meets. The first facts made public concerning it have just come out in a court case at Victoria, relative to a question as to the ownership of certain documents taken from the files of C. E. McDonald, a sub-contractor on the dredging of earth and rock for the new piers of the outer wharf. Gordon E. Mallory, who was superintending engineer last summer for McDonald, gave the documents in question to G. H. Barnard, M.P. for Victoria. The latter turned them over to the court for a declaration as to who was the rightful owner, and as to whether or not any of the facts contained in them could be made use of publicly.

When the question came before the court recently, at Victoria, Mallory swore that there had been an over-classification of the work from approximately 5,000 cubic yards of solid rock to 20,000 cubic yards or more. The price allowed by the Government for rock excavation was $7 per cubic yard. In his evidence Mallory declared that the fraud on the country was approximately $150,000.

The evidence further showed that Nelson, although occupying the position of Superintendent of Dredging, and, therefore responsible for seeing that the work was done honestly and economically, assisted McDonald to get the contract, backed him financially, and saw that he got generous estimates of the quantities excavated, so that progress payments would be sufficient to make the financing easy.

The court has decided that the documents shall remain impounded for three months, pending further investigation. Meanwhile Mr. Nelson's resignation has been accepted.

G. T. P. STEAMSHIPS

ACCORDING to information received at Grand Trunk Pacific headquarters in Montreal, the G. T. P. steamships operating in the North Pacific Coast waters have covered over eighty thousand miles during the season of 1915. This is considered one of the most remarkable records in the coastwise trade.

Running between Prince Rupert and Seattle the steamship "Prince Rupert," between June 8 and November 4, steamed 40,717 miles, almost twice the distance round the world. Her sister ship the "Prince George," covered 40,840 miles. The average distance run per day by these vessels was 395.86 miles, and the average speed per hour 16 49 knots. In order to keep their schedules, these steamships often steamed over 18 knots, reeling off better than 400 miles in a day. The steamships were timed to arrive at Seattle at 6.30 a.m. and 4 p.m., respectively—equal to any railway schedule.

Travel between North Pacific coast points remains fairly good and service is to be maintained between the Transcontinental trains of the company at Prince Rupert and the cities of Victoria, Vancouver and Seattle throughout the winter.

Principles of Laying-Off Cylindrical Intersections---V.

By J. W. Ross

The more or less special nature of the work involved in the making of sheet metal piping has caused many manufacturers to avoid this class of work, with the result that when a job has to be handled, there is frequently considerable unnecessary loss incurred through errors in laying off material. The examples treated by the writer of this article should form a valuable reference to many manufacturers on ordinary as well as special occasions.

RECTANGLE INTERSECTING A CYLINDER.

THE same principles are adopted in this or similar problems as was adopted in the preceding problems of intersections. Fig. 38 shows the perspective, Figs. 39 and 40 the elevation views. Enough information can be obtained from the drawings without any explanation. Develop the patterns, Figs. 41 and 42, in precisely

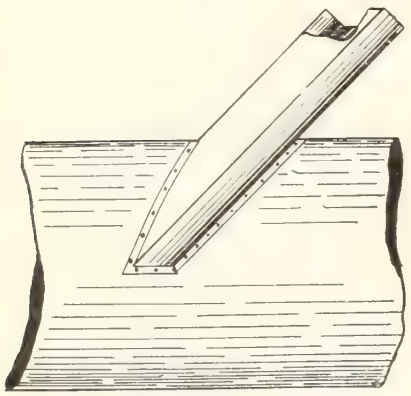


FIG. 38.

the same manner as the problem shown in Figs. 34 and 35.

Connecting Pipe Between Two Circular Tanks.

The perspective view, Fig. 43, and the elevation, Figs. 44 and 45, show a connecting pipe between two circular tanks. This problem deals with heavy plate. The patterns are developed in accordance with the instructions given on heavy plate in development of the problem shown by the Figs. 18 and 19.

*Note: The reference letters and numerals in the text, i.e., G^2, 7^2, etc., correspond with those of the illustrations indicated as G", 7", etc.

Y or Three-way Pipe.

The intersection of three pipes forming a Y is shown in the perspective drawing, Fig. 49, and the elevation view, Fig. 50.

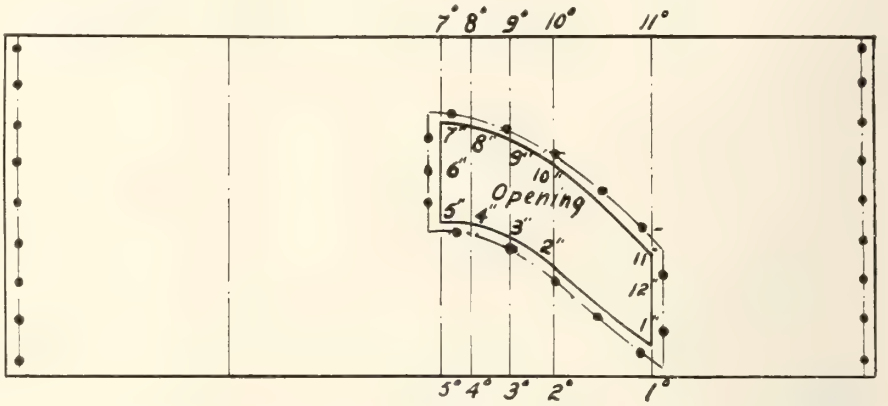


FIG. 42.

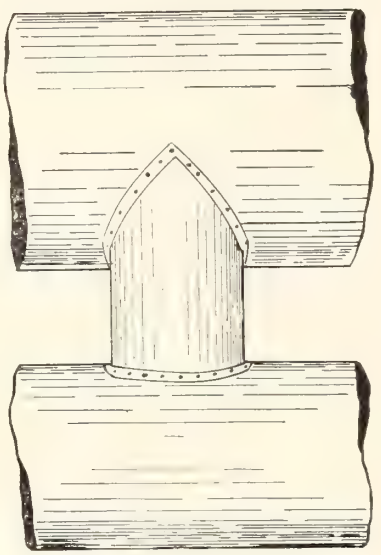


FIG. 43.

Construction.

Draw the horizontal line, 7° 1°, Fig. 50, equal to 1 inch. Bisect at 4° and erect the perpendicular 4° 7^1. Locate the point 4^x, 7/8 in. from 4°. At an angle of 45 degrees to the horizontal

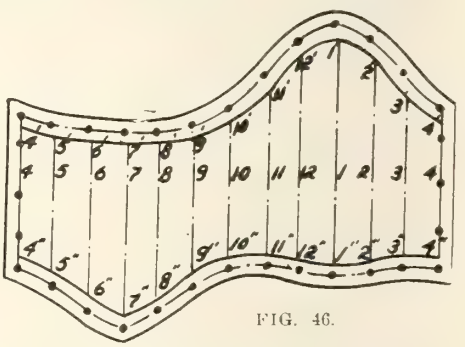


FIG. 46.

line draw the inclined line 4^x 10. Also line 4^x 4, each equal to 1 5/8 inches. At right angles draw the line 7 4 1 equal to 7° 4° 1°. Draw the line 7 7^1 parallel to 4^x 10—to the intersection of the vertical

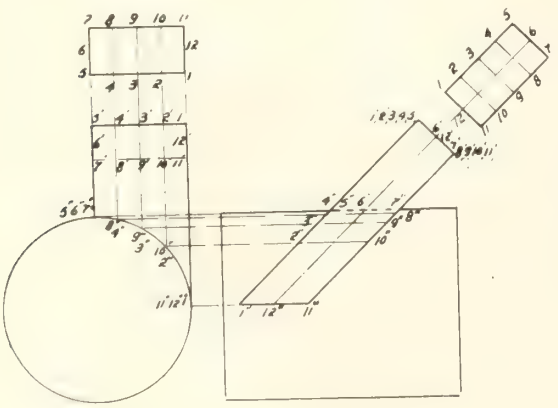


FIG. 39.

FIG. 40.

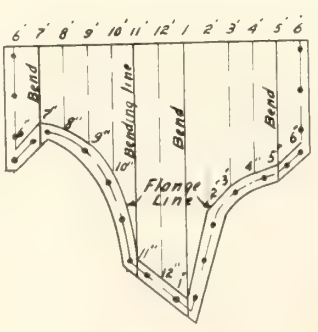


FIG. 41.

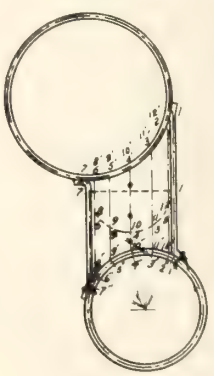


FIG. 44.

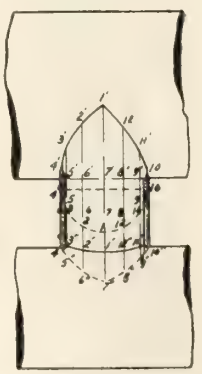


FIG. 45.

line 4° 7'. Also parallel to 4^x 10 draw the line 1 1^x to the intersection of the vertical line 1° 1^x. Connect 4^x to 1^x. Construct the left-hand side of Fig. 50 in a similar manner. Then 7^2 4^x 1^x defines the

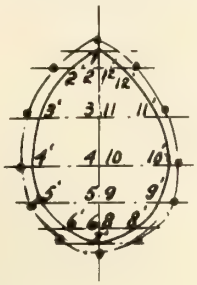


FIG. 47.

FIG. 48.

mitre line for the lower course, and 1^x 4^x 7^1 for the inclined course. With O as centre describe the plan view, 1 4 7 10. Divide into 12 equal spaces. Project these points to the mitre line, 7^2 4^x 1^x. Again, with X as centre describe the plan view of the inclined pipe as shown by the circle 1 4 7 10. Divide into 12 equal spaces. Project these points —parallel to 10 4^x—to the mitre line

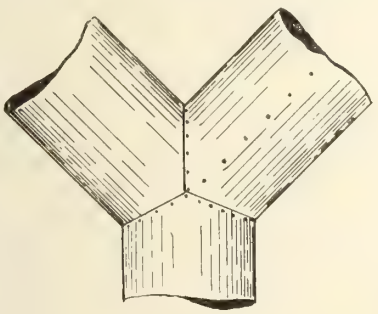


FIG. 49.

7^1 4^x 1^x. Draw the stretchout 1^x 1°, Fig. 52. Divide into 12 equal spaces. Transfer the measurements 1° 1^x, 2° 2^x, 3° 3^x, etc., Fig. 50, to their similar lines in Fig. 52. Draw a curve to define the mitre or flange line; add the laps. Space in the rivet holes. Similarly transfer all the

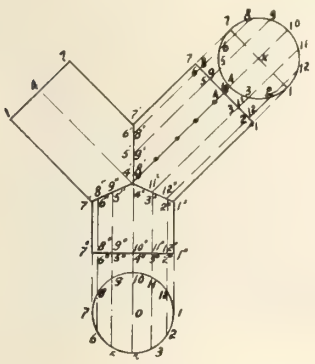


FIG. 50.

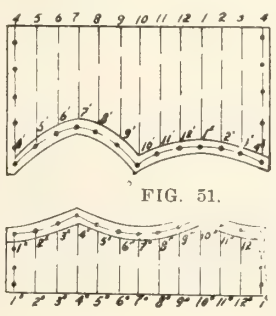


FIG. 51.

FIG. 52.

element lengths of the inclined cylinder to their respective points on the calculated stretchout, Fig. 51. Fig. 51 will be the templet for both the inclined cylinders. The preceding problems cover fairly well the various intersections developed by parallel lines.

OPENING OUT AN ENGINE

AN Old Hand sends a note on overhauling, which will commend itself to careful engineers. He says:—On going into an engine-room, either ashore or afloat, it does not take long to tell the class of men who have been entrusted with repairs. Joints of cylinder covers, steam chests, dash-pot covers, pump covers, heads of keys and of cotters, nuts and set screws, may be bruised almost out of identification, or be as spick and span as when they left the maker's hands.

Great differences are noticeable—some installations being as smart, after twenty years' service, as others after the first overhaul. It is no unusual experience, when a gang of men are told off by the man in charge to open out an engine, that the first thing he hears is that one of the gang, in wedging off the steam chest cover, has smashed a corner off. Another has so upset the cotter that drilling-out is needed. Another has taken "big" or "little" ends adrift and thrown the liners, which may have been interposed, in a heap and no record taken. Another may have gripped a piston-rod with "bare clamps" and so bruised its surface that a skim in the lathe, with all its attendant bushing of glands and new neck rings, is an absolute necessity.

A different class of men go about such a simple job in a proper manner—preparing their tools, down to the smallest pin-punch and key-drift, well before, and keeping them ready for any emergency. What a treat it is to see such men take such a job in hand! There is no fear of them "making a job." All is first examined for original marking; notes are taken of different details; trammels are set for parts which have been adjusted to length, such as valve rods; keys are marked the distance driven in; heights of glands are measured and all cotters of adjustable journals carefully marked.

Special care is taken in respect of all covers which have red-lead or similar joints attached. Discreet use is made of thrust screws, which, in all well-designed engines, are provided for pressing jointed covers off. Even with such screws great care is necessary, for, if too much is put on one screw and too little on others, a fracture of the cover may result. It is always best to slack the nuts of the cover bolts an equal amount, say, one turn each all round, and then with the thrust screws to press the cover off to this limit; then another turn and so on, until the cover is fully released. If a case is found where no thrust screws are provided, the same plan of unscrewing nuts should be followed and thin steel wedges used—plenty of them—to distribute round the periphery of each cover.

If the cover does not start under what is considered a fair strain by the steel wedges, the fitter should, with a hand hammer and a strip of soft copper, persistently "sole" the surface of the cover all round the joint until he sees the red lead falling away in powder. The kind of man who can do such a job without accident is worth his weight in gold.—Practical Engineer.

ELECTRICAL MACHINERY OPERATION

ELECTRICAL machines, says "Vulcan," are so easy to manipulate when all is right that they are frequently placed in charge of persons who neglect the little modicum of attention they require, with the result that troubles, stoppages, and expense are needlessly incurred.

A primary essential to comfortable running of electrical machines is that they should be kept clean and free from dust, oil and water. It is not much to ask, but no end of troubles are traceable to accumulations of this kind about the windings, terminals and commutator. Bearings should be properly lubricated and not allowed to wear loose. If there is ring lubrication, the rings should dip into the oil, but not too deeply or their rotation will be hindered. Periodically the oil wells should be emptied and all sediment removed.

Commutators should be kept clean and bright. A little vaseline may be applied occasionally, and no copper dust should be allowed to collect on the insulation between the bars or about the junction of the armature windings with the bars. Brushes should be kept well trimmed and raised out of contact when the machine is standing. For proper running it is necessary not only for the brushes to be correctly placed with reference to one another, but they should bed accurately on the surface of the commutator throughout their entire thickness and width. Imperfections in this respect are often a cause of serious sparking.

Sparking Troubles

Another source of sparking trouble is the incorrect position of the brushes, and the best position is a matter which should be regulated by some one with technical experience. One result of wrong position is that a flat is liable to be worn on one or more segments of the commutator, though another cause is oil or dirt on the accumulator itself, or it may be that the armature is out of balance. A defect of this kind may also be aggravated by slight vibration set up,

if a dynamo is belt-driven, by the passing of a belt joint over the pulley causing the brush to be slightly kicked out of contact at each revolution.

For this reason belts, if jointed, should be made with a long splice. It is, of course, better still if the belt is endless. If a flat does occur and is discovered before it has gone too far, it is best cleaned out by applying emery cloth on a curved wood block; but if the flat is bad, it can't be cured in this way. If it is a slow-running machine it may be remedied by filing it out and slightly reducing the segments on each side so as to cause as little departure from the circular form as possible, but it should be remembered this is not a perfect job, and if the machine runs at high speed the best cure for the defect is to put the armature into the lathe and take off a very slight cut, and polish with emery to a perfectly smooth surface, care being taken to protect the armature from any copper dust given off by the lathe while this is being done.

Although much may be done to avoid troubles with electric machines by the exercise of ordinary care and attention, periodical inspection by a skilled expert is a valuable supplement, as little defects which might become big ones can then often be detected in time to avoid subsequent trouble.

BOILER FAILURES UNDER HYDRAULIC TEST

THE great value of a hydraulic test as a supplement to visual inspection is acknowledged by all concerned in the management and safe working of steam boilers, and cases in which the timely application of a water pressure test has revealed important defects are of constant occurrence. The fact that a boiler successfully withstands a hydraulic test should not, however, be taken to indicate that it is free from serious defects, as experience proves to the contrary.

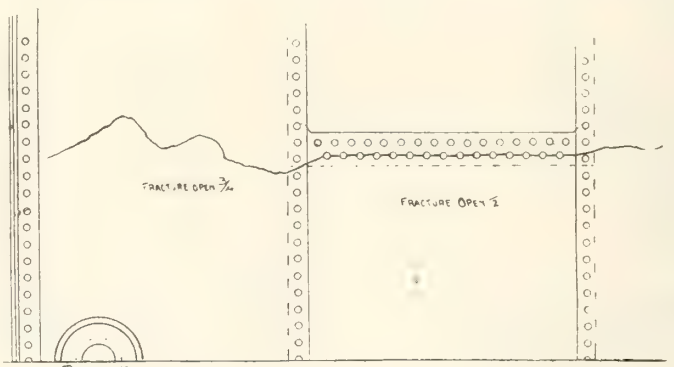
Two cases of failure under hydraulic test, due to defects that could not have been discovered by visual inspection, are thus described in "Vulcan," and will be of interest as showing the utility of such tests in the case of very old boilers, even when the plates are apparently in good condition.

Example.—I.

In the first case, the boiler was constructed of iron plates, and was about 40 years old, but had not been worked for over ten years. In order to ascertain whether the boiler was suitable for a further period of service, a special examination was made, and it was found that the plates were generally in good condition. A hydraulic test was subsequently applied, and the pressure was raised to 120 lbs. per square inch. After this pressure had been sustained for ten minutes the shell of the boiler ruptured at the lower longitudinal seam of the second belt of plates from the front end.

The rupture started between the rivet holes of the seam, which was ripped along its full length, and the fracture then extended into the solid plate of the adjoining rings, as shown in the illustration. The longitudinal riveted seams were of poor design, the rivets being so closely pitched that the calculated efficiency of the joint would only be 59 per cent. of that of the solid plate, instead of from 65 to 70 per cent.

At the test pressure of 120 lbs. per square inch, the stress on the material where it failed between the rivet holes was equal to 20,900 lbs., or 9.3 tons per square inch of section, a stress well within the elastic limit of good iron boiler plates, and which, therefore, should not have damaged the boiler if the plates had been in normal condition. The fractured plates showed a clean and new break of a crystalline nature, and there is no doubt that the failure of this boiler was due entirely to fatigue of the material, as a result of the stresses set up under ordinary working conditions extending over a long period of service.



SHOWING FRACTURE OF AN OLD BOILER UNDER HYDRAULIC TEST.

Example.—II.

In the second case, the boiler was about 25 years old, and was constructed of steel plates. As in the case of the first boiler, the longitudinal seams were lap-jointed with two rows of rivets, and the shell similarly ruptured under hydraulic test at one of the longitudinal seams. In this instance the fracture did not follow the line of rivet holes for its full length, but extended into the body of the plate outside the rivet holes. The test pressure in this case was raised to less than 50 per cent. above the working pressure, and the fracture was clean and bright, while the thickness of the plate at that part had not been reduced by wasting or grooving.

This boiler had a fair calculated margin of safety, so that the stress in the plate set up by the application of the hydraulic test did not exceed the elastic limit of the material had it been normal. This would also appear to be a case of internal deterioration of the material due to fatigue.

In both the foregoing instances the hydraulic test was applied for the purpose of revealing any hidden defects, and in each case the pressure at which the boiler failed was less than half the calculated bursting pressure.

ELECTRICITY FROM BELT SLIP

THAT the unavoidable slight slip of all running belts on their pulleys produces static charges of electricity in these two bodies has often been remarked, and it has sometimes been suggested that this has been the cause of mysterious explosions in powder works. Interest, therefore, attaches to a simple device for removing this charge, described by W. T. Estlick, in the Electrical Review and Western Electrician.

It was used in a textile mill where cotton looms were running with rubber work, so that it was necessary to keep the room perfectly dry. These conditions caused the accumulation of large charges of electricity in the belts of the motors driving the looms, with the result that the belts attracted all the particles of lint floating about, eventually shaking them on to the yarn and making the work dirty. The bits of lint would also gather in the motor and when this was blown out would settle on the work.

On two occasions also a squirrel-cage motor burnt out, apparently from no other cause than that of the charge in the roter discharging to earth by sparking across on to the stator winding and puncturing the insulation. Copper strips connected to earth were then placed above and below the belt, brushing lightly against it. After this no more burning out occurred, and the collection of particles of lint was also prevented.

Lost Shipping Cost.—The cost of the more important steamship casualties during October is estimated by the Liverpool Underwriters' Association at £2,277,651, of which £1,498,500 is attributable to the war. Sailing ship losses amounted to £78,500, of which £4,000 was due to the war. In October of last year the steamship losses were estimated at £3,208,000, of which £2,714,500 was attributable to the war, and sailing ship losses amounted to £54,500. For the corresponding month of 1913 the steamship and sailing ship losses were £496,000 and £14,000 respectively.

Marine Terminal of the G.T.P. Rly. at Prince Rupert, B.C.

Staff Article

The construction and installation of a floating drydock, together with a shipbuilding and ship repairing plant at the Western Terminal of the Grand Trunk Pacific Railroad, constitute an engineering achievement of no mean magnitude. Aside, however, from the latter feature, the establishment of such a combination plant is indicative of the far-seeing policy pursued and developed by the railroad management relative to its Pacific Coast shipping.

THE primary consideration in the development of this drydock undertaking was the isolated geographical position of the town of Prince Rupert from the nearest supply base, some 600 miles.

To facilitate the erection of the complete plant, the structures first built were utilized in constructing the remaining buildings and docks. The first work to be completed was the pier and launching platform, followed by the erection of the power house and the installation of the necessary equipment. After the completion of the engineering and administration buildings, the final work of constructing the 20,000-ton pontoon floating dry dock was successfully accomplished, and the operating machinery erected in position.

A general view of the shipbuilding

The opening of the new dock is an event of much importance, not only to the town of Prince Rupert, but to the many shipping interests in British Columbia and adjoining territory.

plant and dry dock, and the latter with a large vessel aboard are shown on this page, and serve to indicate the plant capacity.

Floating Dry Dock

The entire dry dock, with a total lifting capacity of 20,000 tons, is composed of three distinct and separate, but interchangeable units. The centre unit of six pontoons, with an overall length of 269 feet, is capable of raising and supporting a vessel of 10,000 tons; while each end section, of three pontoons, and a length of 164 feet, will carry a weight of 5,000 tons. These pontoons are united by steel side walls or wings, 38 feet high, 15 feet wide at the bottom and 10 feet wide at the top.

The structure as a whole is secured to the pier by the engagement of clamps on the dock with a vertical truss, secured to the pile platform in such a way that it is free to rise and fall with the tide (which in the spring is often 25 feet), and when being raised or lowered with a vessel aboard.

When it is desired to use the dock in separate sections, the forward three pontoons can be detached and moved around the corner of the pier and located alongside the platform. To use the remaining portion as two separate docks, the middle section of six pontoons is detached from the rear section and moved forward the length of the front section, and secured in position. The sliding clamps are so arranged that whether the

THE NEW FLOATING DRYDOCK WITH A LARGE VESSEL ABOARD.

VIEW OF G.T.P. MARINE TERMINAL, PRINCE RUPERT, B.C., SHOWING HARBOR, FLOATING DRYDOCK AND WORKSHOPS.

dock is used as separate units or complete, the attachments on the pier will coincide with those on the floating dock.

Each pontoon is of timber construction, 130 feet by 44 feet by 15 feet deep, with a crown of 3 inches at the centre, and having 15 trusses spaced on 3-foot centres. A water-tight bulkhead, 12 inches thick, runs below the keel blocks of each section, and partial bulkheads on each side are used to strengthen the structure. The entire dock is made water-tight by caulking with white pine wedges, and protected from toredo and other marine worms by a coating of tar and gravel, poisoned with arsenic. Over this are two layers of hair felt, similarly treated, and covered with creosoted lumber secured with galvanized nails.

Pumping Machinery

The operation of lowering and elevating the dock is accomplished by twenty-four 12-inch centrifugal pumps, one in each end of each pontoon. The pumps on each side of the three sections are connected by a vertical shaft and gearing, with a horizontal shaft to a motor placed on the top of the pontoon wall. Two 200 h.p. motors are used on the centre section, and the pumps on the end sections are operated by four 100 h.p. motors, one on the wall of each section.

The motors are alternating current, 3-phase, 25-cycle, 550-volt, with wound rotors and slip rings for variable speed control. The armature operates at about 500 revolutions per minute, and drives the pumps through reducing gearing at 275 r.p.m.

Workshops and Their Equipment

All buildings are of steel frame construction, with roof and floors of reinforced concrete; the walls of the power plant are also of reinforced concrete, those of the other buildings being, in addition, covered with wood. The entire equipment is of the most modern type, and machinery installed is capable of handling the heaviest and largest repairs that may be required upon any vessel operating on the Pacific Coast.

In laying out the general plan for the present site, the possibility of future shipbuilding developments was carefully considerd, and, while the construction of steel vessels will not materialize for some time to come, it was nevertheless deemed advisable to construct buildings of a permanent nature.

The broadside system of launching has been provided for.

Pier Derrick

An interesting feature in connection with this terminal is the pier derrick shown here. This crane has a hoisting capacity of 50 tons, and is capable of taking care of the removal or installation of the heaviest pieces of machinery from or to the hold of vessels in Northern Pacific waters. It is also used for the unloading of material from vessels lying at the dock to cars upon the pier. Drydock and plant features are given in brief as follows:—

Type of dock—Floating.

Built by Grand Trunk Pacific Railway Co.

Location—Prince Rupert, B.C.

Estimated cost—$2,500,000.

Capacity of dock—Two sections of 5,000 tons each, 1 section of 10,000 tons; total, 20,000 tons.

Drydock Dimensions

Overall length on keel, 604 ft.

50-TON PIER DERRICK.

Clear width, 100 ft.
Width overall, 130 ft.
Number of lifting pontoons, 12 only.
Length of each, 130 ft.
Width of each, 44 ft.
Depth of each, 15 ft.

Buildings

Foundry, 75 x 150 ft.
Machine shop, 75 x 150 ft.
Boiler and blacksmith shop, 75 x 150 ft.
Shipbuilding shed, 160 x 300 ft.
Power house, 104 x 148 ft.
Side launch platform, 440 x 80 ft.
Chimney on power house, 175 ft. high, 11 ft. diam.

General

Quantity of lumber in 12 pontoons, 4,000,000 ft.

Quantity of galvanized fastenings in pontoons, 400 tns.

Weight of each pontoon, 490 tns.

Lifting capacity of each pontoon, 1,700 tns.

Quantity of bolts and spikes, 360 tns.

Quantity of steel in wings of dock, 2,400 tns.

Number of rivets used in dock, 500,000.

Number of 12-in. centrifugal pumps, 24.

Capacity of each per minute, 5,000 gallons.

Time required for pumping entire dock, 1½ hours.

Quantity of paint used on wings, 13,000 gals.

Quantity of fireproof roofing used, 130,000 sq. ft.

Quantity of lumber in wharf, 3,000,000 ft.

Quantity of piling in wharf, 268,000 lin. ft.

Quantity of filling, 303,000 yards.

Area of yard, 20 acres.

Length of ship that can be docked, exclusive of overhang at bow or stern, 600 ft.

Width of ship which can be docked, 95 ft.

Maximum draft of ship that can be docked, 30 ft.

The power house contains two 1,000 k.w. turbo-generators and a large air compressor. A system of underground electrical conduits has been installed throughout the shipyard, as well as compressed air lines. The boiler room equipment will consist of six 400 horse-power water tube boilers, having automatic chain grate type stokers, such as are known to give satisfaction with Pacific Coast coal.

The ship-shed is provided with two 10-ton travelling cranes, and vessels can be constructed in this building under cover. The engineers who designed the dock and were in charge of construction are Messrs. Frank E. Kirby and Wm. T. Donnelly, of New York, J. H. Hillsbury, of Prince Rupert, acting as their local representative on the work. Chas. H. Crowell is general manager and superintendent of the dry dock.

LAKE FREIGHTERS SOLD FOR OCEAN SERVICE

TWO lake freighters of the type very much in demand have changed ownership. Both are steel vessels, which have been in the Great Lakes trade for several years. They are the steamers G. R. Crowe, of the St. Lawrence & Chicago Navigation Co., and the Algonquin, of

the Port Colborne & St. Lawrence Steamship Co.

The steamer Crowe, which has been sold to an English syndicate, will be converted into an oil tank steamer for Atlantic coastwise and Gulf of Mexico service. The work of remodelling the Crowe will be done at Midland, where she will winter. The sale price of the Crowe was not divulged. Lake ships are in great demand just now for the overseas trade, and it is announced that the Crowe brought a good profit to her late owners.

The G. R. Crowe was built in Dundee, Scotland, eight years ago for the St. Lawrence & Chicago Navigation Co., and is a steel steamer, 331 feet long, with a 43-foot beam, and a moulded depth of 26 feet.

The Algonquin is well known in Toronto harbor, and was one of the first steel steamers to be brought to Canada. She was built by R. Napier & Sons, Glasgow, Scotland, in 1888, for Thomas Marks & Co., of Port Arthur. The Algonquin, which latterly has been sailing under the flag of the Port Colborne & St. Lawrence Steamship Co., has been purchased by A. B. Mackay, of Hamilton, who recently negotiated the sale of the steamer Turret Chief to a British syndicate.

It is understood that the Algonquin will be remodelled for overseas service during the winter. She is a sister ship to the Rosedale, and has plied with uninterrupted success on the Great Lakes since her arrival from across the ocean.

LACHINE CANAL 1915 SEASON

FINAL figures regarding the Lachine Canal navigation season of 1915, show that 41,352,876 bushels of grain were brought down as against 67,343,952 bushels in 1914, a decrease of 25,991,076 bushels. Of all the grains, only corn showed an increase, the 702,736 bushels brought down this season being 592,803 bushels more than in 1914. Wheat showed the greatest decrease, the 30,443,678 bushels received being 19,445,565 bushels under last year's total. The other figures for this year, with the decrease in each case, are as follows: Oats, 8,499,035 bushels, decrease 3,690,542; barley, 1,276,810 bushels, decrease 2,937,673; rye, 23,135 bushels, decrease 250,087, and flaxseed, 407,482 bushels, decrease 260,012.

The total number of vessels which used the canal were 590, as against 615 last year, a decrease of 25; but their combined net tonnage this year amounted to 249,050, an increase of 19,795 tons. The total number of trips was 7,820, which was 1,229 trips less than in 1914. As a result, the total combined tonnage for these 7,820 trips only amounted to 4,110,579, or 879,393 tons less than in 1914. The total tonnage of grain and miscellaneous cargoes carried was 964,916 tons under the 1914 figures, the total for this year being 3,265,294. There were 63,294 passengers carried through the canal and down the rapids, as against 90,989 in 1914.

The statistics for the year also show the following balances of advantage for 1914: Let passes issued last year, 5,764, this year, 4,820; lockmasters' tickets up, 1,334 and 1,018; lockmasters' tickets down, 3,014 and 2,560; permits to pleasure craft, 312 and 187; coal, 1,138,738 and 1,070,138 tons, a decrease of 68,600 tons to harbor, canal basin and up the canal; trips made light for return cargoes, 3,418 in 1914 and 2,942 in 1915, a decrease of 476. Deducting the number of trips made light from the total number of trips made, the result shows that only on 4,878 occasions did vessels carry cargoes, as against 5,631 times in 1914.

Building Materials Carried

In building materials, lumber brought down from Ottawa for United States ports unexpectedly showed a considerable increase, 19,107,600 feet board measure, or 46,214 tons having come down this year. Also there were 41 rafts of 5,000 lineal feet each, making a total of 205,000 lineal feet, or 4,100 tons, which passed through to the harbor during the season. There were 48,297 tons of sand up from the harbor to the canal basin, a decrease of 17,416 tons, and 44,866 tons down, a decrease of 23,778. This makes a total decrease of sand carried as compared with 1914 of 41,194 tons.

There was an increase of 1,019 cords of pulpwood up to Canadian ports, the total amount being 23,759 cords; and a decrease of 5,459 cords to American ports, that total for the season being 137,951 cords. This makes a total decrease of 4,440 cords. No pulp went to Canadian ports at all this year, as compared with 1,600 tons in 1914; also 26,137 tons went to American ports this year as compared with 36,012 tons last year, making a total decrease of 11,475 tons.

The comparative figures for "up or westbound" traffic and "down or eastbound" traffic are as follows:—Number of trips, up, 3,864; down, 3,956; tonnage of vessels reported, up, 2,008,474; down, 2,102,105 net tons; cargo tonnage, up, 799,203; down, 2,466,091 net tons; number of passengers carried, up, 15,846; down, 47,448.

Seagoing Tonnage

The following figures indicate that though there was a falling off in the total tonnage passing through the canal, the American tonnage increased:—Canadian steamships, 178 in 1915, and 190 in 1914; American steamships, 46 of 52,651 net tons, as compared with 27 steamships of 26,270 net tons in 1914; Canadian barges, scows, etc., 215 in 1915, and 255 in 1914; American barges, 6, as against 9 in 1914; American canal boats, 145 of 14,683 net tons in 1915, and 134 of 13,206 net tons in 1914. Of the Canadian steamships reported, some 50 vessels with a tonnage of 58,702 operated in coastal and overseas trade during the season. Of the American steam vessels reported, 18 vessels, having a total net tonnage of 25,241, passed out for American ports in consequence of the law forbidding railways to own steamships.

Because of the million sacks of flour in the gift to the Imperial Government from the Dominion in 1914, this year's total for flour passing through the canal is 123,273 sacks, being 1,040,985 sacks under last year. The comparative figures for 1914 and 1915 respectively for produce carried through the canal as follows: Eggs, 14,909, and 14,465 cases, a decrease of 444; butter, 6,544, and 4,984 packages, a decrease of 1,560; cheese, 194,834, and 221,212 boxes, an increase of 26,378; apples, 30,448, and 25,131 barrels, a decrease of 5,317.

The first vessel down in the spring was the W. H. Dwyer, which was entered on the canal books on April 23, with 73,636 bushels of wheat, and the last boat through the canal was the Wylie M. Egan, with coal.

SHIPBUILDING ON THE CLYDE

LITTLE of any consequence can be said with regard to the progress that is being made on merchant-ship construction on the Clyde, although it is probable that this class of work is making more headway now than has been the case at any time during the year. An average launching output of only about 20,000 gross tons per month, however, as has been the case during the present year, is surely a startling figure for the largest shipbuilding river in the world, which in normal times turns out an average of well over 60,000 tons of merchant and naval ships in a similar period.

Good progress continues to be made with the work on hand to the order of the Admiralty, and it is still true that as many men as possible are being employed on these vessels. A number of mercantile steamers in course of construction, which were originally laid down for private owners, have been taken over by the Admiralty or by the Governments of our Allies, and in these cases also the vessels are being pushed forward with all possible speed.

During November, Clyde shipbuilders launched four merchant ships of 7,400 tons, making a total of 212,000 tons for eleven months. The total last November was 36,000 tons, and the total for eleven months 443,000 tons. The aggregate for the same period two years ago exceeded 600,000 tons, and in the two previous years 500,000 tons.

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NAVIGATION SEASON 1915: ITS RECORD AND ITS CALL

THE 1915 season of navigation now closed on Canada's inland waters has been, taken as a whole, generally satisfactory. The transfer of many lake craft early in and during the year to ocean service did much to offset the lean and opening months in so far as revenue production was concerned, and the successful transportation of a record per centage of a record crop in the period from September 1 to December 12, removed all doubt as to the revenue assuming substantial proportions.

On our lakes and rivers during 1915 there has been a pleasing absence of disaster and tragedy, casualties being for the most part light relative to both men and ships. Stormy, and recently quite wintry weather has prevailed on numerous occasions, but thanks largely to beforehand advice being transmitted to the various ports and signal stations by the Weather Bureau, the necessary steps were taken by vesselmen to remain in or procure shelter.

The year 1915 in a world sense, however, has borne on its bosom a weight of marine tragedies and disasters Storm and tempest in their wildest and angriest moods, or in their most comprehensive operation scope have but a mean record to their credit compared to that established by man's ingenuity and artifices in the prosecution of this world war. On sea as well as on land a myriad masterpieces of man's brain and brawn have been destroyed and annihilated, and, no less true is it, that of men themselves—brave and unflinching, thousands have found a watery grave in one section or another of the Seven Seas.

Reference has been made to the transfer of many lake craft to ocean and ocean coasting service, this having become necessary because of the scarcity of "bottoms" in these spheres, the regular traders being employed for the most part on military and naval transport work for the Imperial Government. On a previous occasion we hinted at the possibility of many of our lake craft remaining at sea indefinitely. On account of the rumenerative freight rates, and in view of the fact that transports and merchant vessels as well as battleships, in totals almost shocking, rest on oceans' bottoms, there will be numerous orders that even boom years in shipbuilding will find hard to fill, at least as promptly as will be the need. Again, many of our lake vessels will undoubtedly find the old Atlantic quite too strenuous, especially in its angry winter moods. Some of the craft have already succumbed, and in the nature of things no matter how optimistic one may be and how high may be our opinions of the staunchness and fitness of our lake freighters for ocean service, it is quite inevitable that several more will be called upon to yield to the elements.

In years past, both recent and fairly remote, we have gone to the British Isles for our lake carriers—those of "canal size" particularly. Our vessel stock is becoming quite noticeably depleted, and as stated above, is sure to maintain the tendency in that direction. We will, therefore, wake up to the fact, probably when it is too late, that Canada's trade and commerce has so developed that she needs more ships. Under such circumstances, turning to Great Britain to build for us will be out of the question, for her own merchant marine will be in process of replenishing and will, of course, get first call.

Shipbuilding in Canada needs fostering; it has always needed it, although little was forthcoming. Canada needs merchant ships—lake, coastwise and ocean types—and by grasping the opportunity to place orders for their vessel requirements now, our shipping corporations would be directly helping themselves and incidentally establishing the shipbuilding industry of this Dominion on a sound and prosperous basis.

Marine News From Every Source

Safer Year on Lakes.—Fewer vessels have met mishaps and less damage has been sustained on the Great Lakes this season than for several years.

Port Arthur, Ont.—The Western Dry Dock & Shipbuilding Co.'s plant will be working to capacity during the coming winter months. The company have on hand several freighters for lake service.

Port Arthur, Ont.—Freight rates from Port Arthur to Buffalo recently rose from a rate of from three and a half to four cents a bushel, which prevailed during the regular season, to five and a half cents.

North Vancouver, B.C.—The City Council will immediately take steps to offer some inducements for the establishment of a drydock on the North Shore. The Board of Trade will support the scheme.

Port Arthur, Ont.—The Canadian steamer, W. Grant Morden, the longest boat on the lakes, left on Dec. 9 for Port McNicoll with 760,000 bushels of oats, the largest cargo ever taken from this port, being equivalent to 400 loaded cars.

Brockville, Ont.—The Department of Marine and Fisheries has awarded the contract for the erection of a lighthouse on the river front at Fulford's Point, west of here. The building will be twenty feet high with concrete foundation.

Fort William, Ont.—A record which will likely stand for many years in lake shipping was made between midnight, Nov .30, and midnight, Dec. 1, when thirty-one steamers cleared for the east, with the huge total of 7,464,000 bushels of grain, 6,474,000 of which was wheat.

Ottawa, Ont.—Ten million dollars is the capital stock of the British-Canadian Steamship Co., which has been incorporated here this month, with Montreal head office. It has secured wide powers incidental to the carrying on of a general steamship business.

School of Navigation.—The second session of the School of Navigation at Queen's University, Kingston, Ont., opened on December 14, and will continue for three months. The school will be in charge of Capt. H. M. McMaster, assistant superintendent of the Montreal Transportation Co.

Picton, Ont.—The body of Captain Herbert La Rush, of the tug Frank C. Barnes, lost in Lake Ontario, was taken from the water at Wellington on Dec. 3. For two years he was master of the steamer Toronto, and at the close of the present season took command of the tug.

Navigation Closed at Soo.—Navigation was officially closed at Sault Ste. Marie on Dec. 15, which is one day later than the time of closing last year. The last boat to pass through the Canadian locks was the Collingwood of the Farrar Line, with a load of coal for Fort William.

Buoys Are Withdrawn.—All remaining buoys in the Livingstone Channel, and in East and West Bar Point Channels have been withdrawn for the season. The gas buoys in Lake St. Clair and St. Clair River, and the Lake St. Clair light vessel, will be withdrawn by December 18, if weather conditions are favorable

Halifax, N.S.—Tenders will be received by the Governor of the Province of Macao, up till January 8, 1916, for the supply of a steel, self-propelling dredge for the use of the Macao Harbor Works. Full particulars may be obtained at the office of Fred H. Oxley, Consul for Portugal, Keith Bldg., Halifax, N.S.

Last Vessel From Quebec.—The closing of navigation in Quebec comes rather late this season, as the last vessel leaving Quebec steamed out of port on Dec. 15, the Lady of Gaspe leaving for Halifax, to load for England. There is now a vast quantity of ice all over the river and in the harbor. Some three score vessels have taken up their winter quarters at Quebec.

Owen Sound, Ont.—The Canadian Pacific Great Lakes fleet of steamers, Assiniboia, Keewatin, Manitoba, Athabasca and Alberta, have been ordered to this port for winter quarters, where they will undergo extensive repairs, for which contracts have been let to local contractors. This will be the first time that all the boats have been here since the removal of the upper lakes headquarters to Port McNicoll four years ago.

Schooner Wrecked.—The schooner Lavengro is a total loss at Burn Point Sago, Nfld., having been driven ashore during a gale. The crew were saved.

Schooner Wrecked. — The schooner Companula, coal laden from Sydney, N. S., to Newfoundland, was driven ashore on the west coast of Miquelon during a gale on Thursday, Dec. 9. The Companula was abandoned. The crew were saved.

Sarnia, Ont.—After lying on the bottom of the river at the Reid dock for the last two years, a section of the wrecked steamer W. C. Moreland is being made ready to be taken to a lower lake dry dock. The stern portion of the boat was salvaged from Sawtooth Reef, Lake Superior, by building bulkheads across and pumping her out. The portion is owned by Roy Wolvin, of Winnipeg, and a new forward end will be built in time for the opening of navigation next spring.

Dipper Dredge Burned.—On Thursday forenoon, Dec. 2, the large dipper dredge, Edmund Hall No. 1, employed in dredging at the new wharf at Rocky Point, opposite Charlottetown, P.E.I., was destroyed by fire. She has had an unlucky career since coming to Charlottetown. This summer, while dredging on the site of Marine Slip she capsized into the cutting and was badly damaged. The dredge is owned by V. T. Bartram, Toronto, and cost about $50,000.

Fitting Propeller in Mid-Ocean.—Captain Pederson and crew of the Tyne trader Ulriken have been handsomely rewarded for exceptional service at sea. The vessel, which belongs to Bergen, while on a passage from the Tyne to Sydney, C.B., was missing over four weeks. The owners had abandoned all hope of seeing her again, when word was received that, though she had arrived all well, the propeller had dropped off in mid-ocean, and the crew had very ingeniously fixed the spare propeller. This task occupied nearly three weeks. The vessel had to be tipped, and the operation could only be carried on during fine weather. The Bergen Insurance Co., in recognition of the valuable services rendered, have presented the officers and crew with $3,000 among them, according to their ratings. The Ulriken was 41 days on the voyage.

St. Pierre, Miq.—Officers and crew of the British steamer St. Kilda, which foundered off the west coast of Miquelon in a storm, were brought to St. Pierre, Miq., on Dec. 13, aboard a tug which went to their assistance as they escaped from the vessel and landed on the cliffs. Fears had been expressed in marine circles that the crew would not be found and that the men were in great danger as the cliffs offered little shelter from the storm. The captain of the St. Kilda reported that the vessel was a wreck.

Toronto Harbor Work.—It is announced that the Toronto harbor work in the vicinity of Cherry Street is to proceed as weather permits. The Canadian Stewart Co., the contractors, have undertaken to make good the defective construction by a sub-contractor disclosed upon examination by Government experts, and the work will proceed without further hitch in favorable weather. The restoration of the imperfect contruction will be done without cost to the Government, it is said. The contractors say there will be no unnecessary delay.

Soo Canal Tonnage.—Over 5,000,000 tons increase in a month of freight tonnage through St. Mary's Falls Canals over November last year is indicated in the monthly statistical report of lake commerce recently published. Copper, iron ore, wheat and grain comprise the majority of the items of increase. Of copper, 33,983 tons were transported east; iron ore, 4,494,967 tons; wheat, 20,338,360 bushels; grain, 74,388,678 bushels. For November, 1914, the figures were: Copper, 24,454; iron ore, 1,-115,779; wheat, 14,936,019; and grain, 32,770,253 bushels.

Life and Vessel Losses.—Reports received by the British Board of Trade during November tell of the sinking of 53 British steamers, with a total net tonnage of 61,072, and the loss of 646 lives. In the same period the loss was reported of 35 British sailing vessels, of 4,977 net tonnage, with six lives. So far as the figures show, only twenty of the steamers were sunk by German warships and ten by mines, but 495 of the lives lost were on steamers sunk by German warships. These figures do not record the total casualties for November, but merely the reports received, some of which relate to previous months.

Pacific Fleet Purchase.—The American International Corporation, recently organized by interests connected with the National City Bank and other prominent financiers, announced on Dec. 13, the purchase of the entire remaining fleet of the Pacific Mail Steamship Co., consisting of seven steamships. In this venture, the corporation has secured the co-operation of William R. Grace & Co., importers and exporters, between the United States and South America, who are represented on the board of the new International Corporation. Incidentally, by this step, the last fleet of vessels under the United States flag on the Pacific Ocean will not suffer complete disintegration.

Oil Carrier Launched.—The steamer Royalite, the first of three oil-carrying steamers under construction at Collingwood, Ont., for the Imperial Oil Co., at the yards of the Collingwood Shipbuilding Co., was successfully launched at noon on Dec. 15. Miss Margaret Hanna, daughter of Hon. W. J. Hanna, Provincial Secretary, gracefully performed the christening ceremony in the presence of a large number of spectators. The vessel will be used in carrying oil on the Great Lakes, but is equipped with all necessary appliances for ocean service. The principal dimensions are: Length, 258 feet; beam, 43 feet; depth, 18 feet. After the launch, the guests, which included Hon. and Mrs. W. J. Hanna, Miss Hanna, Thomas Long and Capt. J. B. Foote, had luncheon together.

Navigation Closes on St. Lawrence — Navigation in the St. Lawrence route officially closed on November 29, when the removal of the gas buoys which mark the route commenced. These aids to navigation, however, were replaced, as usual, by spar buoys, which will remain to indicate the channels to those vessels which continue to make trips until ice conditions forbid. The date chosen is about the same as during the last few years. During the coming winter the new car ferry provided by the Intercolonial Railway as a car ferry between Cape Tormentine and Summerside, P.E.I., will be operated by the Marine Department. It will run between Pictou and Charlottetown as a ferry, and piers are now under construction for this purpose.

Two Tugs Burn.—Two tugs, the C. M. Bowman and the Maud L., which left Owen Sound on the morning of Dec. 12, for Midland, the former in tow of the latter, were destroyed by fire at 2.30 o'clock the following morning while lying at anchor at Vail's Point Harbor. While cleaning the flues of the Maud L. with a steam jet, a back draft of soot exploded, and blew the fire out of the furnace, igniting the wood work. Capt. Geo. Dunn, the owner of both tugs, was in the bunkers at the time, and had only time to arouse the crew and get into the yawl when the boat burst into flames. The Bowman, which was being towed to Midland for an extensive overhaul, was tied alongside, and soon became enveloped in flames, and in two hours both vessels were burned to the water's edge, the Maud L. sinking in 25 feet of water at her anchor, while the Bowman drifted ashore and burned out. The Bowman was 95 feet over all, with an 18-foot beam. The Maud L. was 73 feet over all, with a 15-foot beam. There was a fire risk on both tugs.

C. G. S. Minto—The Canadian ice-breaking steamer Minto has been sold to the Russian Government for use in keeping the port of Archangel open during the coming winter. She has sailed with a Canadian crew for Archangel, where she will be handed over to the Russian Government. The Minto was built in Dundee, Scotland, in 1899, and specially designed for winter navigation in Northumberland Strait. She is 225 feet long, of 1,090 gross tonnage and 2,900 indicated horsepower. She will be replaced by the Government steamer Stanley, while next year the new ice-breaker, which is being built by Canadian Vickers, but which has been held up by the war, will be completed as an addition to the ice-breaking equipment of the Marine Department.

Captain William McGregor, of Windsor, Ont., the veteran commodore of the Grand Trunk and Wabash car ferries, while walking through the railway yards on Dec. 6, slipped and fell directly in front of a switch engine. He managed to throw himself to one side of the rail, but his left leg was caught beneath the wheels and so badly crushed that amputation was necessary. Despite great loss of blood, Capt. McGregor, who is over seventy years old, retained consciousness and talked with the surgeons as they dressed his injuries. He was removed to Harper Hospital, Detroit, where one of his daughters is a nurse. For the past forty years Capt. McGregor has been identified with Grand Trunk Railway marine interests, and he is one of the best known men in vessel circles along the chain of lakes.

Montreal Harbor Tug Christened.—A further indication of the growing activity of the port of Montreal was emphasized recently by the christening of the new Harbor Commissioners' tug, David Seath, which will bring the number of these boats in use to eleven, whereas five years ago there were only six. All these tugs, with the exception of the Sir Hugh Allan, have been constructed in the Harbor Commissioners' own shipbuilding yards at the Mackay (Guard) pier, where several hundred men are kept employed. The David Seath, named after Major Seath, who at the end of this month will have completed his seventeenth year as secretary-treasurer of the Harbor Commission, is 100 feet in length and a particularly sturdy craft. It will be used from now till the end of the season to replace other tugs, and will be put in regular operation next spring.

SCOTTISH SHIPBUILDING

VERY few mercantile vessels were launched from Scottish shipyards during November. With the exception of those of April and May, the total makes the lowest monthly figure this year. It consists of only eight vessels of 8,148 tons. Of these, three vessels of 7,270 tons were built on the Clyde, one of 250 tons at Alloa, and three of 628 tons at Aberdeen. The Clyde total for the eleven months consists of 75 vessels of 211,877 tons, which is less than that of last year at the same date by no fewer than 131 vessels and 228,887 tons, and by that of 1913 by 163 vessels and 416,939 tons.

These figures are not of course anything like so significant as they appear, as in those of last year there are included six months of warship launches, and in those of 1913 the complete twelve months of naval work. Their significance lies really in the way in which they show that a great deal of unrecorded work has been, and is still being done; but even if we could compare mercantile work only, it would be found that there is a very large decrease in the output—due wholly to the concentration of the yards on naval work.

DOMINION COAL CO. ST. LAWRENCE SEASON

THE quantity of coal transported to St. Lawrence ports by the Dominion Coal Co. during the 1915 season of navigation was about 1,600,000 gross tons. In addition to this, something over 100,000 tons will have to be handled through Portland over the ensuing winter months, making a total for St. Lawrence ports of 1,700,000 tons.

A slightly larger quantity was transported to Montreal during the 1914 season, but the difference is accounted for by the fact that steamers formerly taking large bunker supplies to St. Lawrence ports were diverted to Sydney in the season just past, and bunkered either on their inward or outward voyage.

Steamers employed in the coal-carrying trade made 310 trips to St. Lawrence ports during the season of navigation just ended, and vessels from the Upper Lakes, as well as the seven seas, were secured in order to carry this large amount of coal at a time notable for shortage of tonnage.

LAST VESSEL TO SEA

WHEN the Port Dalhousie left Montreal Harbor on Dec. 10 on her journey towards Pictou, N.S., where she was to deliver the 2,375 tons of pig iron put in her holds at Chicago, it marked the end of navigation—St. Lawrence to the sea for the year 1915, and an end just one week later than occurred in 1914. On December 4, 1914, the last vessel passed out of the port.

The Port Dalhousie went to sea on what is believed to be the latest period in the history of the port. It is not the latest period for vessels to come down through the canal, as the Port Dalhousie herself last year arrived at the Dominion Flour Mills in the canal basin at 2.30 o'clock on the afternoon of December 15, after a most adventurous voyage. She had left Fort William on November 20, but had been delayed by a slide in the Welland Canal, and by ice conditions which she encountered in the lake and river trip from there on to Montreal.

S.S. "DONNACONNA" FOUNDERING

THE first detailed story of the sinking of the Donnaconna reached Halifax recently, when the Furness liner Shenandoah brought Captain Lawrence, of Hantsport, and three officers of the ill-fated vessel, T. N. Medcalfe, of Toronto, J. Levesque, first officer, and J. Roper, second officer, both of Gaspe. A broken rudder, heavy seas that spoiled food and fresh water, and an exciting rescue in a little fisherman's dory, which took the crew and officers to the steamship Ariel, figured in their story. The captain's story of the mishap, as reported in the Halifax Chronicle, is as follows:—

"We sailed from Maryport, Cumberland County, England, on October 7, with a cargo of manganese ore for Montreal. The first day out we ran into heavy weather, which lasted in varying degree until we landed in England again from our rescue ship. For ten days after our departure from Maryport, we struggled against the storm and made good headway, but on the 17th of the month our rudder was smashed. For two days previous we had been in a hurricane and this was the culmination. We managed to rig up a jury steering gear and made a little distance southwards for twenty-four hours, after which the rudder was swept away altogether and we were helpless.

"We had raised our distress signals and kept a sharp lookout for passing steamers. We sighted a big ship a long distance away and hoped that she would see us, as we were not sufficiently far south to be in the regular path of steamers, and might not see another for some time, but she was too far away, and could not have noticed our plight. Finally we sighted the steamer Ariel, bound from Montreal to Newcastle, and she spoke us. The storm was still raging, and that night she stood by. Next morning we were told that the Ariel could not undertake to tow us to port, but they would take us off the steamer and back to England, if we wished. As the Donnaconna's cargo was shifting, and as the ship was rolling heavily and helplessly, I decided to accept their offer. We managed to transfer to the Ariel in the heavy sea with some difficulty."

The crew of the Donnaconna were paid off in England, and the second and third engineers secured berths out of English ports.

WINTER MAIL PORT CONTROVERSY

IN the annual controversy between Halifax, N.S., and St. John, N.B., as to their respective merits as winter ports, a letter written by Sir Thomas Shaughnessy, president of the Canadian Pacific Railway Co., is taking a very important place this year. The letter was in reply to one from Sir Robert Borden, who had placed before Sir Thomas Shaughnessy telegrams and letters from the Halifax City Council and Board of Trade registering strong protests against sending the Corsican and other mail ships to St. John without calling at Halifax. The letter of Sir Thomas Shaughnessy to Sir Robert Borden reads as follows:—

"I wish that it were possible to comply with your request to have our passenger ships call at Halifax on the inward and outward trips this winter, but, as I said to you personally, I am convinced that it cannot be done in the interest of the country.

"The war has brought upon us a condition of things with reference to our Atlantic steamship service that could not have been foreseen, and that it will be difficult for us to satisfactorily meet, even with our greatest efforts. As you know, a great many of our ships have been taken by the Admiralty, and we have found it impossible to charter a sufficient number to replace them.

"In these circumstances we must either utilize such steamships as are available to the utmost, or we must permit a substantial percentage of our Canadian exports to be diverted from Canadian ports.

"Apart from all other considerations, the Halifax call would involve a delay to our passenger ships of from two or three days on each round voyage, with a like reduction in their freight carrying efficiency. Our endeavor must be this winter to avoid unnecessary detention of a single hour, so as to secure the fullest advantage of their carrying capacity. By running direct to and from St. John, in these exceptional circumstances to which I have referred, no precedent is being established.

"When normal conditions return, the Halifax mail service and the terms upon which it is to be conducted will be open for consideration."

ASSOCIATION AND PERSONAL

A Monthly Record of Current Association News and of Individuals
Who Have Been More or Less Prominent in Marine Circles

E. M. Smith, president of the American Shipbuilding Co., who owns the dry dock at Port Arthur, Ont., died suddenly at Buffalo, N.Y., on Dec. 8.

Lieut. F. Y. Harcourt, who for several years has been district harbor engineer at Port Arthur, Ont., has received a commission in the 94th Battalion of the C.E.F.

John L. Nelson, who came to the Province of British Columbia in March, 1913, as superintendent of dredging, has sent in his resignation to the Department of Public Works.

H. S. Carmichael has been appointed freight and passenger agent at London, England, of the Canadian Pacific Ocean Services. He completes twenty years' service with the C. P. R. this month. H. S. Dring succeeds him as passenger agent of the C. P. R.

The Canada Steamship Line, Montreal staff have enlisted for overseas service. The eligible men are to be enlisted in one battalion, and officers, who are to go to Halifax at once to qualify for commissions, will lead the company. There are forty-six Canada Steamship Line in the trenches now.

Marine Officials Move.—The offices of the Toronto branch of the Department of Marine and Fisheries have been moved from the Foy Building, to 59 and 61 Victoria Street. Captain H. W. King, inspector of masters and mates; Hull Inspector W. Evans; and Boiler Inspectors Dodds, Stewart and Arnold, will in future have their headquarters at the latter address.

The Canadian Association of Boat Manufacturers at a meeting held in Toronto, elected the following officers:—Hugh Warnock, Penetang, president; M. L. Butler, Brighton, 1st vice-president; W. R. Richardson, of Peterboro', 2nd vice-president; A. F. Fenton, Toronto, secretary; and Herbert Ditchburn, Gravenhurst, treasurer, succeeding Capt. C. H. Rogers, of Peterboro', who is now in France.

Captain George W. Murchison, a sailor on the Great Lakes, chiefly Lake Ontario, for over 35 years, died on Nov. 26 at his home, 31 Starr Avenue, Toronto, after a prolonged illness. Capt. Muchison was born in the old Murchison homestead, Bathurst Street, north of Robinson Street, Toronto, 65 years ago. He was owner of the steamer Niagara before selling the vessel to a Buffalo syndicate, and was for several years connected with the old Doty Ferry Co., which was afterwards taken over by the Toronto Ferry Co. A few years ago Capt. Murchison abandoned steamboating for fruit farming.

Captain Joseph Bernier, late commander of the good ship Arctic, and famed as an Arctic explorer, has taken up land. The captain during his northern cruise established fishing stations at Button Point, Bylot Island, in Baffin Bay and on Baffin Island, at the junction of the Salmon River with Pond Inlet. He has erected houses at these stations, and has now procured from the Government a transfer of the lands, 30 acres at Button Point and 60 acres on Baffin Island, at a dollar an acre.

Visitors to Montreal Harbor.—After having been entertained by the Harbor Commissioners and the City of Montreal at dinner, the nine members of the Terminal Commission of the Commonwealth of Massachusetts, who arrived in Montreal on Dec. 9, left for Boston the following night. During the afternoon the harbor works were inspected. W. G. Ross, president of the Harbor Commission; Col. A. E. Labelle, another of the commissioners; David Seath, J. Dalrymple, vice-president of the G.T.R.; Hon. P. E. Blondin, Paul Mercier, and S. P. Brown, engineer of the Canadian Northern Tunnel Co., accompanied the party. The "Duke of Connaught" floating dry dock was visited.

LICENSED PILOTS.

ST. LAWRENCE RIVER.

Captain Walter Collins, 43 Main Street, Kingston, Ont.; Captain M. McDonald, River Hotel, Kingston, Ont.; Captain Charles J. Martin, 13 Balaclava Street, Kingston, Ont.; Captain T. J. Murphy, 11 William Street, Kingston, Ont.

ST. LAWRENCE RIVER, BAY OF QUINTE, AND MURRAY CANAL.

Captain James Murray, 106 Clergy Street, Kingston, Ont.; Capt. James H. Martin, 259 Johnston Street, Kingston, Ont.; John Corkery, 17 Rideau Street, Kingston, Ont.; Captain Daniel H. Mills, 272 University Avenue, Kingston, Ont.

ASSOCIATIONS

DOMINION MARINE ASSOCIATION.

President—A. E. Mathews, Toronto. **Counsel**—F. King, Kingston, Ont.

GREAT LAKES AND ST. LAWRENCE RIVER RATE COMMITTEE.

Chairman—W. F. Herman, Cleveland, Ohio
Secretary—Jas. Morrison, Montreal.

INTERNATIONAL WATER LINES PASSENGER ASSOCIATION.

President—O. H. Taylor, New York.
Secretary—M. R. Nelson, 1184 Broadway, New York.

THE SHIPPING FEDERATION OF CANADA

President—Andrew A. Allan, Montreal; **Manager and Secretary**—T. Robb, 218 Board of Trade, Montreal; **Treasurer**, J. R. Binning, Montreal.

GRAND COUNCIL, N.A.M.E. OFFICERS.

L. B. Cronk, Windsor, Ont., Grand President.
A. F. Hamelin, Montreal, Que., Grand Vice-President.
Neil J. Morrison, P. O. Box 238, St. John, N.B., Grand Secretary-Treasurer.
E. Read, Vancouver, B.C., Grand Conductor.
A. J. Ross, Halifax, N.S., Grand Doorkeeper.
James Gillie and A. E Kennedy, Kingston, Ont, Grand Auditors.

1915 Directory of Subordinate Councils, National Association of Marine Engineers.

Name.	No.	President.	Address.	Secretary.	Address.
Toronto,	1	Chas. M. Arnott,	94 Hanley Street	J. S. Adams,	71 Gladstone Ave.
St. John,	2	G. J. McVicar,	49 Winslow St. West	T. G. Blewett,	36 Murray St.
Collingwood,	3	Wm. Whipps,	Collingwood, Ont.	Robert McQuade,	Collingwood, Ont.
Kingston,	4	L. E. Spencer,	24 Clergy St.	James Gillie,	101 Clergy St.
Montreal,	5	Henry Lamereaux,	280 St. Andre St.	O. L. Marchand.	8 Clark St.
Victoria,	6	John E. Jeffcott,	Esquimault, B.C.	Peter Gordon,	808 Blanchard St.
Vancouver,	7	W. G. Wooster,	Room 10, Jones Bldg.	E. Read,	Room 10-12, Jones Bldg.
Levis,	8	Michael Latulippe,	Lauzon, Levis, Que.	S. G. Guenard	Bienville, Levis, Que.
Sorel,	9	Nap. Blandon,	Sorel, Que.	Alf. Charbonneau,	Box 204, Sorel, Que.
Owen Sound,	10	John McLeod,	570 4th Ave.	J. Nicoll,	714 11th Ave. East
Windsor,	11	Alex. McDonald,	28 Crawford Ave.	Neil Maitland,	71 London St. W.
Midland,	12	Geo. E. Wilson,	P.O. Box 204	Roy N. Smith,	Box 178
Halifax,	13	Robt. Blair,	29 Preston St.	Chas. E. Pearce,	Portland St., Dartmouth, N.S.
Sault Ste. Marie,	14	Charles H. Innes,	27 Euclid Rd.	Geo. S. Biggar,	43 Grosvenor Ave.
Charlottetown,	15	Philip Bridges,	Stewart St.	Chas. Cumming,	27 Easton St.
Twin City,	16	H. W. Cross,	336 Ambrose St	E. L. Williams	142 Secord St., Port Arthur, Ont.

Catalogues

Don't Waste Your Fuel is the title of a folder issued by the James Morrison Brass Mfg. Co., Toronto. The folder describes and illustrates two patterns of recording gauges for steam pressure, vacuum and temperature ranges.

Piston Rings—"To Save and to Hold Power"—is the title of a bulletin issued by W. H. Banfield & Sons, Toronto, Ont., and describing the "Leak-Proof" piston ring. The bulletin first of all deals with piston rings in a general way and then proceeds to describe in detail the principal features of "Leak Proof" rings. The method of making these rings is described, followed by instructions for installing and the variety of uses.

The Phenix Force Feed Lubricator, Bulletin No. 50, recently issued by the Richardson-Phenix Co. of Milwaukee, Wis., contains a complete description of the Phenix ratchet type lubricator; it also describes a new type, known as the model "T." The catalogue contains an interesting diagram, giving a comparison of the way in which mechanical and hydrostatic lubricators feed oil to engine cylinders. Numerous illustrations show the application of the Phenix lubricator to different types of engines, pumps, steam hammers, etc.

EASTERN TIDE TABLES

THE 1916 Tide Tables for the Eastern Coasts of Canada, including the River and Gulf of St. Lawrence, the Atlantic Coast, the Bay of Fundy, Northumberland and Cabot Straits, with information on currents, have been issued by the Tidal and Current Survey in the Department of the Naval Service of Canada. They are based upon observations obtained by means of self-registering tide gauges, which are kept in continuous operation day and night throughout the year.

The length of time through which these records have been kept justifies W. Bell Dawson, superintendent of Tidal Surveys, in claiming that these tide tables are now superior to the tide tables for any harbor on the Atlantic Coast of the United States from Maine to the Gulf of Mexico. Special features of the tides at the different points of reference and of the dominant currents of the river are also shown.

THE SYREN AND SHIPPING 1000TH NUMBER

OF particular interest to marine men, and more than general interest to all loyal citizens of the Empire is the special number of "The Syren and Shipping Illustrated," which was recently published in celebration of the 1000th appearance of this magazine.

To shipping interests in all parts of the globe, the Syren has become an indispensable medium for the transmission of news, comment, criticism and information, and while the one hundred and sixty-three pages of reading matter which feature this issue are deserving of more than passing interest, even the casual observer cannot fail to be impressed with the galaxy of authors who have contributed to this unique publication.

The period covered by its existence from 1896 has been marked by many momentous developments in the marine world. Men whose names are inseparably linked with Britain's maritime greatness have passed away. Disasters, almost unbelievable in magnitude and possibility have occurred, while developments in the application of science to every line of activity in marine work have been equally as great.

Britain's growth as an Empire is indissolubly bound up in her supremacy on the ocean, and the history of this growth, with some of the men who have helped it in the past and will do so in the future, is briefly indicated in the fifty-four articles contributed by men of political and industrial eminence. The contents are in the form of short reviews of subjects regarding which the various writers are fully qualified to express opinions.

"Development of Liquid Fuel," by Sir Maicers Samuel, Bart. "The Early Development of Marine Engineering," by Sir Benjamin C. Browne, M.I.N.A., M.Inst., M.E. "Twenty Years of Mercantile Shipbuilding," by Professor W. S. Abell, M.Inst. C.E., M.I.N.A., and "Electric Arc Welding," by R. S. Kennedy, M. Inst. M.E., are a few of the articles which appeal more directly to the technical reader.

Canadian shipowners and workers have not escaped unscathed the trials and perils of the present struggle, and the value of their aid is attested by D. Lloyd George, who through the Syren and Shipping, sends the following "Message to the Men of Our Mercantile Marine:" "This country owes a great debt to its mercantile marine. Our merchant shipping has been called upon to bear its share—no small share—in this great European struggle. New conditions have had to be met, arduous duties undertaken, long hours worked, and many difficulties overcome. As our armies are fighting overseas and in some cases at great distances from our shores, a heavy burden has been imposed of necessity on the men of our mercantile marine on whom we must rely for the prompt and sure transport of munitions of war and other material without which the best efforts of our brave men at the front would be in vain; and I am convinced that the nation can depend on the same patriotic and devoted service in the future as in the past."

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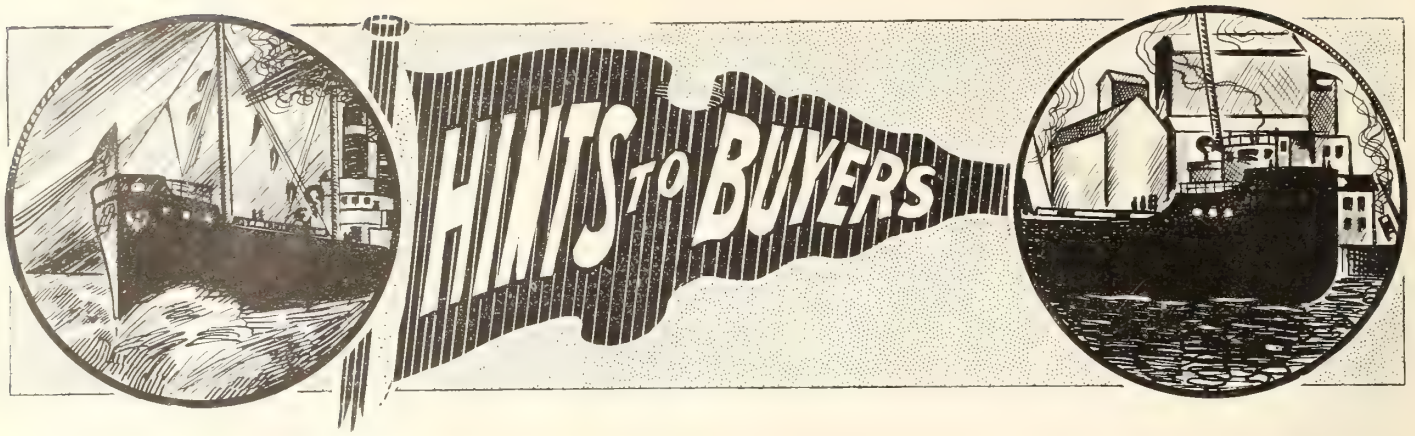

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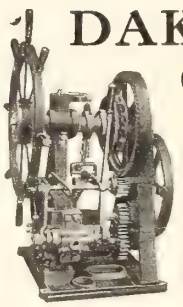

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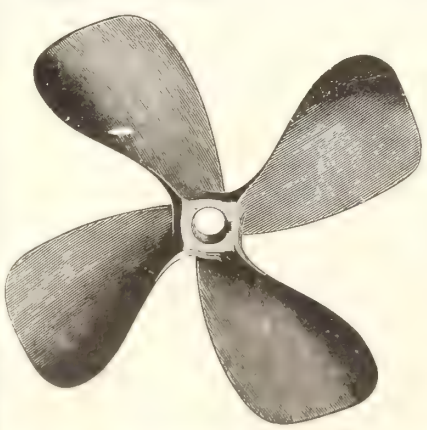

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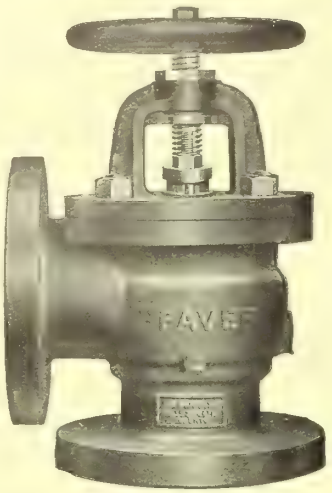

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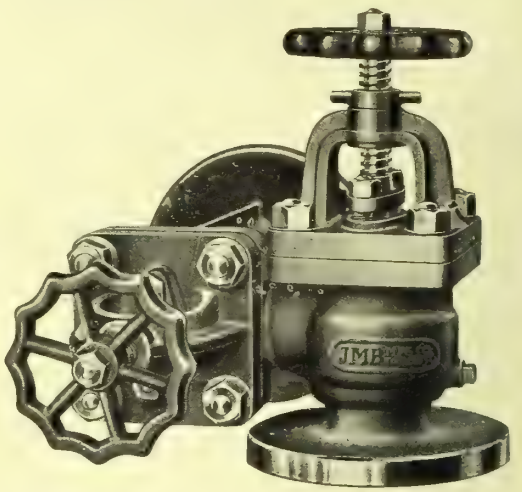

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